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CONNECTICUT RIVER FLOOD CONTROL PROJECT

EAST HARTFORD, CONN.

CONNECTICUT RIVER, CONNECTICUT

SPECIFICATIONS

FOR

MEADOW HILL PUMPING STATION

ITEM E.H.6c - CONTRACT

JULY, 1941

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE PROVIDENCE, R.I.

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR CONSTRUCTION OF

MEADOW HILL PUMPING STATION

ITEM EH-6c (CONTRACT)

EAST HARTFORD, CONNECTICUT

JUNE 24, 1941

(Issued July 28, 1941)

CORPS OF ENGINEERS, U. S. ARMY
U. S. ENGINEER OFFICE PROVIDENCE, R.I.

No.____ Bidder_____ Invitation No. 699-42-24
(Do not write above this line)

STANDARD GOVERNMENT FORM OF INVITATION FOR BIDS
(Construction Contract)

War Department
United States Engineer Office
Providence, R. I.
July 28, 1941

SEALED BIDS, in duplicate, subject to the conditions contained herein, will be received until 2:00 p.m. Eastern Daylight Saving Time, August 12, 1941, and then publicly opened, for furnishing all plant, labor, and materials except the equipment to be furnished by the Government as provided in the specifications, and performing all work required by the drawings and specifications for the construction of Meadow Hill Pumping Station, located on the east bank of the Connecticut River in East Hartford, Connecticut.

I. THE WORK shall be in strict accordance with the specifications, bidding schedule and drawings, designated as follows:

Specifications for construction of Meadow Hill Pumping Station, Connecticut River, East Hartford, Connecticut.

The drawings which will become a part of this contract are designated in Paragraph 1-04 of the specifications. Where copies of drawings are requested, no deposit will be required.

II. GUARANTY will be required with each bid as follows: Bid bond, Standard Form No. 24, will be executed in a penal sum approximately equal to and not less than ten (10) percent of the total amount of the bid. Individual sureties will justify in sums aggregating not less than double the penalty of the bid bond. (See Paragraphs 8 to 11, inclusive, of Instructions to Bidders.) Certified check may be furnished in lieu of bid bond.

III. PERFORMANCE AND PAYMENT BONDS will be required from the successful bidder as follows:

a. A performance bond with good and sufficient surety or sureties, for the protection of the United States, Standard Form No. 25, will be executed in a penal sum approximately equal to and not less than fifty (50) percent of the full amount of the consideration of the contract.

b. If the consideration of the contract will exceed $2,000.00 in amount, a payment bond with good and sufficient surety or sureties, for the protection of persons furnishing material and labor for the work, Standard Form No. 25-A, will be executed in a penal sum equal to fifty (50) percent of the full amount of the consideration of the contract, when

the latter is not more than one million dollars ($1,000,000.00); forty (40) percent where the contract exceeds one million dollars ($1,000,000.00) but is not more than five million dollars ($5,000,000.00); and two million five hundred thousand dollars ($2,500,000.00) for all contracts above five million dollars ($5,000,000.00).

IV. LIQUIDATED DAMAGES for delay will be prescribed. (See Paragraph 1-07 of the specifications.)

V. TAX ADJUSTMENTS. - Provisions for tax adjustments will be made a part of the contract. (See Paragraph 1-12 of the specifications.)

VI. PARTIAL PAYMENTS will be made. (See Article 16 of the contract and Paragraph 1-10 of the specifications.)

VII. ARTICLES ON PATENTS will be made a part of the contract. (See Paragraph 1-17 of the specifications.)

VIII. BID AND CONTRACT. - a. Bids must be submitted upon the Standard Government Form of Bid and the successful bidder will be required to execute the Standard Government Form of Contract for construction. The bid form has an entry for each item on which estimates will be given or payments made, and no other allowances of any kind will be made unless specifically provided for in the specifications or the contract. Bids shall be for the entire work and shall have each blank filled.

b. The quantities of each item of the bid, as finally ascertained at the close of the contract, in the units given and the unit prices of the several items stated by the bidder in the accepted bid, will determine the total payments to accrue under the contract. The unit price bid for each item must allow for all collateral or indirect cost connected with it.

c. The successful bidder will be required to return the contract duly executed and to furnish the performance and payment bonds herein described, within ten (10) days after the papers are presented to him.

IX. EXPERIENCE. - a. Each bidder shall state in his bid whether he is now or ever has been engaged on any contract or other work similar to that proposed, giving the year in which it was done and the manner of its execution, and shall submit such other information as will tend to show his ability to prosecute vigorously the work required by these specifications.

b. The successful bidder will be required to employ an organization thoroughly experienced and skilled in the manufacture, fabrication, and installation of the crane, lighting system, and other equipment that is to be furnished and installed in the pumping station. After the opening of bids, any bidder may be required to submit satisfactory evidence that the specific organizations which he proposes to employ on this portion of the contract have successfully executed work of the nature and quality indicated above.

X. COMMENCEMENT AND COMPLETION. - Work shall be commenced within ten (10) calendar days after receipt of notice to proceed and shall be completed in accordance with the provisions of Paragraph 1-07 of the specifications. A preference rating of A-2 has been obtained for contracts now in force for the flood protection of East Hartford. It is expected that a similar preference rating will be given for items under the contract to be entered under this invitation.

XI. MINIMUM WAGE RATES for the locality of the work have been determined by the U. S. Department of Labor. (See Articles 17 and 19 of the contract and Paragraph 1-35 of the specifications.)

XII. EIGHT-HOUR LAW. - The requirements of the Eight-Hour Law, Article 11 of the contract as modified by Section 303, Public No. 781, 76th Congress, approved September 9, 1940, will be applicable to the work under the contract.

XIII. ARTICLES ON PREFERENCE for domestic materials will be made a part of the contract. (See Article 18 of the contract and Paragraph 1-31 of the specifications.)

XIV. REPORTS TO THE DEPARTMENT OF LABOR. - In order to assist the Department of Labor in obtaining employment statistics, bidders, unless otherwise indicated in their bids, will be considered as having voluntarily consented, without cost to the Government, to the inclusion of Paragraph 1-36 of the specifications as a part of the contract.

XV. INVESTIGATION OF CONDITIONS. - Samples of borings taken at the site of the work can be seen at the U. S. Engineer Laboratory at Providence, Rhode Island, where they should be inspected by prospective bidders. Bidders are expected to visit the locality of the work and acquaint themselves with all available information concerning the nature of the structure excavations and the local conditions bearing on transportation, handling and storage of materials. They are also expected to make their own estimates of the facilities needed, and the difficulties attending the execution of the proposed contract including local conditions, availability of labor, uncertainties of weather, and other contingencies. In no event will the Government assume any responsibility whatever for any any interpretation, deduction, or conclusion drawn from the examination of the site. At the bidder's request, a representative of the Government will point out the site of the proposed operations. Failure to acquaint himself with all available information concerning these conditions will not relieve the successful bidder from responsibility for estimating the difficulties and costs of successfully performing the complete work.

XVI. FACILITIES AVAILABLE FOR CONSTRUCTION are described in Paragraph 1-06 of the specifications.

XVII. DATA TO BE SUBMITTED WITH BIDS. - a. Each bidder shall submit with his bid drawings showing proposed plant layout and charts showing the rate of progress the bidder will maintain on the work, carefully pre-

pared and presented in neat and legible form. These data are considered essential in assisting the contracting officer to determine whether or not the bidder is responsible, experienced in similar types of construction, and that his bid is based on a careful study of construction methods applicable to the work, and prepared with a full realization of the various factors which may affect its progress.

b. The drawings indicating the plant layout shall clearly show the location and manner of employment of the various major items of plant, the method of excavation and disposal of materials, and the manner in which structural features will be erected.

c. The progress charts shall indicate the volume of work to be done and the rate of progress which the bidder agrees to maintain for each of the following major operations required in the performance of the work under these specifications: (1) Excavation, (2) Concreting, (3) Fill and Backfill and (4) Pumping Station Superstructure. Progress charts shall also be prepared covering work necessary to permit diversion of the Swale flow and completion of the compacted impervious backfill. These charts may be in any convenient form in which the time element shall be plotted to represent definite intervals of time measured from date of notice to proceed with the work, and the volume of work shall be represented by a suitable scale of percentage of completion based on the estimated contract quantities. Careful consideration shall be given to the preparation of the charts as the contractor will be required to maintain the rate of progress indicated thereon.

XVIII. PLANT. - Each bidder shall state in his bid the character and amount of plant that he proposes to employ on the work. After bids are opened any bidder may be required to show that he owns, controls by firm option or can procure the plant necessary for commencing, prosecuting, and completing the work as required by the specifications.

XIX. AWARD OF CONTRACT. - a. Subject to the rights herein reserved, the work will be awarded as a whole to one bidder. The right is reserved, as the interest of the Government may require, to reject any and all bids and to waive any informality in bids received.

b. A bid may be rejected if the bidder cannot show that he has the necessary capital and experience, and owns, controls by firm option or can procure the necessary plant to commence the work at the time prescribed in the specifications and thereafter to prosecute and complete the work at the rate or time specified; and that he is not already obligated for the performance of other work which would delay the commencement, prosecution or completion of the work contemplated in this advertisement.

c. Any unbalanced bid which, in the opinion of the contracting officer, jeopardizes the interest of the Government will be subject to rejection for that reason.

XX. NONREBATE. - Affidavit with respect to nonrebate of wages is required of the contractor within 7 days after the regular payment of each and every weekly payroll. (See revised Article 19 of the contract.)

XXI. ASSIGNMENT OF CLAIMS. - Claims under this contract may be assigned in accordance with the Assignment of Claims Act of 1940 (see Paragraph 1-10 b).

XXII. ADDRESS FOR BIDS. - Bids submitted must be in envelopes with sufficient postage, sealed, marked and addressed as follows:

(Marked in upper left-hand corner)

Bid for construction of Meadow Hill Pumping Station on the Connecticut River at East Hartford, Connecticut.

To be opened August 12, 1941.

(Addressed to)

District Engineer,
United States Engineer Office,
819 Industrial Trust Bldg.,
Providence, Rhode Island.

NOTE: - See Standard Government Instructions to bidders and copy of the Standard Government Forms of contract, bid bond, payment bond, and performance bond, which may be obtained upon application.

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SPECIFICATIONS

SECTION I. GENERAL PROVISIONS

DETAILED SPECIFICATIONS

Invitation No. 699-42-24

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, R. I.

APPROPRIATION: 21X3113 FLOOD CONTROL, GENERAL

MEADOW HILL PUMPING STATION
Item EH-6c
EAST HARTFORD, CONNECTICUT

SPECIFICATIONS

SECTION I. GENERAL PROVISIONS

1-01. Location. - The site of the work covered by these specifications is located on the east bank of the Connecticut River, in the Town of East Hartford, Connecticut.

1-02. Work to be done. - a. The work provided for herein is authorized by the Flood Control Act of June 28, 1938. (Public No. 761, 75th Congress.)

b. The work to be done consists of furnishing all plant, labor, materials, and equipment, except equipment furnished by the Government (see Paragraphs 1-14, 7-19, 9-15 b and Section XVII.), and performing all work required for constructing a pumping station with all appurtenant works, complete in accordance with these specifications, and the drawings forming a part hereof, together with such other incidental work at the site as may be required for completion of the work within the intent and scope of the specifications, or as may be ordered in writing by the contracting officer. It will consist of the following major items:

(1) Construction of the pumping station, intake and outlet structures, conduit, service bridge and other features as shown on the drawings.

(2) Installing major pumping station equipment, including pumps, piping and valves, gasoline engines, and right-angle gear units, to be furnished by the Government.

(3) Furnishing and installing traveling crane, electric light and power system, gasoline-electric standby unit, heating and ventilating equipment, sluice gates and hoists, and other auxiliary pumping station equipment.

1-03. Description of the work. - a. The pumping station will be located adjacent to the East Hartford Dike at Station 190+00±, near the Swale.

b. The pumping station will be built on an earth foundation. The pumping station substructure will be of reinforced concrete. The pumping station superstructure will be constructed with a structural steel frame, brick masonry walls and reinforced concrete roof slab.

c. The contractor shall install in the pumping station four 30-inch pumping units driven by gasoline engines through right-angle gear drive units, one 20-inch pump with electric motor, and gate valves, check valves and piping, all to be furnished by the Government. In addition to installing the aforesaid main pumping equipment furnished by the Government, the contractor shall furnish and install the following auxiliary equipment including all accessories:

(1) Electric motor-driven sump pump.

(2) Fuel supply system for gasoline engines.

(3) Water supply and plumbing fixtures.

(4) Gasoline-electric standby unit.

(5) Electric light and power system.

(6) Carbon dioxide fire extinguishing equipment.

(7) Heating and ventilating equipment.

(8) Sluice gates with electric operating equipment.

(9) Traveling crane.

(10) Trash racks.

1-04. Drawings. - a. The work shall conform to drawings marked, "Connecticut River Flood Control, Meadow Hill Pumping Station, East Hartford, Connecticut," as listed below, which drawings form a part of these specifications and are filed in the United States Engineer Office, Providence, Rhode Island.

LIST OF DRAWINGS

Sheet No.	Title	File No.
1	Project Location and Index	CT-4-2975
2	General Plan	CT-4-2976
3	Stage Hydrograph No. 1	CT-3-1208
4	Stage Hydrograph No. 2	CT-3-1209
5	Subsurface Exploration and Borrow Area	CT-2-1328
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Sheet No.	Title	File No.
10	Details of Conduit and Rack Chamber	CT-4-2981
11	Service Bridge Piers	CT-4-2982
12	Outlet Structure Details	CT-4-2983
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14	Engine Room Floor Plan - Architectural	CT-4-2985
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16	Elevations - Architectural	CT-4-2987
17	Elevations - Architectural	CT-4-2988
18	Sections - "	CT-4-2989
19	Main Entrance and Details - Architectural	CT-4-2990
20	Miscellaneous Details - Architectural	CT-4-2991
21	Cast Stone Details - Architectural	CT-4-2992
22	Structural Steel Framing	CT-4-2993
23	Structural Steel Details	CT-4-2994
24	Roof Slab Steel Reinforcement No. 1	CT-4-2995
25	" " " " No. 2	CT-4-2996
26	Engine Room Floor Slab Steel Reinforcement No. 1	CT-4-2997
27	" " " " " " No. 2	CT-4-2998
28	" " " " " " No. 3	CT-4-2999
29	" " " " " " No. 4	CT-4-3000
30	Boiler Room Floor Slab	CT-4-3001
31	Base Slab Steel Reinforcement No. 1	CT-4-3002
32	" " " " No. 2	CT-4-3003
33	East Wall	CT-4-3004
34	West Wall	CT-4-3005
35	North and South Walls	CT-4-3006
36	Conduit at Building	CT-4-3007
37	Horizontal Sections Steel Reinforcement No. 1	CT-4-3008
38	" " " " No. 2	CT-4-3009
39	Vertical Sections	CT-4-3010
40	Intake Structure - Steel Reinforcement No. 1	CT-4-3011
41	" " " " No. 2	CT-4-3012
42	" " " " No. 3	CT-4-3013
43	" " " " No. 4	CT-4-3014
44	Conduit and Bridge Piers	CT-4-3015
45	Outlet Structure	CT-4-3016
46	Rack Chamber	CT-4-3017
47	Tank Supports	CT-4-3018
48	Service Bridge Superstructure	CT-4-3019
49	Miscellaneous Steel Details No. 1	CT-4-3020
50	" " " No. 2	CT-4-3021
51	" " " No. 3	CT-4-3022
52	" " " No. 4	CT-4-3023
53	" " " No. 5	CT-4-3024
54	" " " No. 6	CT-4-3025
55	General Arrangement of Equipment No. 1	CT-4-3026
56	" " " " No. 2	CT-4-3027
57	" " " " No. 3	CT-4-3028

Sheet No.	Title	File No.
58	Plumbing and Heating No. 1	CT-4-3029
59	" " " No. 2	CT-4-3030
60	" " " No. 3	CT-4-3031
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64	Exhaust Piping	CT-4-3035
65	Electric Light and Power System No. 1	CT-4-3036
66	" " " " " No. 2	CT-4-3037
67	" " " " " No. 3	CT-4-3038

Ten sets of prints of all necessary contract drawings will be furnished without charge, upon request by the contractor. Additional prints will be furnished upon request at the cost of printing.

b. The work shall also conform to such other drawings relating thereto as may be exhibited in the office of the contracting officer prior to the opening of proposals, and to such drawings used in explanation of details as may be required from time to time during construction, including such minor modifications as the contracting officer may consider necessary on account of conditions discovered during the prosecution of the work.

c. Prior to performing the work, the contractor shall check all drawings and shall immediately report to the contracting officer any errors or omissions discovered therein. Quantities stated in bills of material on contract drawings are approximate, and the contractor shall furnish the required quantity without change in unit price. All items to be furnished at lump sum prices shall be provided by the contractor, complete and in good working order, regardless of whether or not they are fully shown or listed on the contract drawings. Parts and details not fully indicated on the drawings shall be detailed by the contractor in accordance with standard engineering practice. Detailed drawings conforming to standard practice shall be furnished by the contractor for the following, as specified in the paragraphs referred to:

Designation	Paragraph Reference
Steel reinforcement bending details	7-18 a(2)
Pumping Station Superstructure	
Structural steel	9-02 b
Glass block	9-04 a
Stone work	9-06 b
Doors	9-07 a
Louvers and ventilators	9-12
Downspouts	9-13 b
Sluice gates, complete with hoists	11-09
Heating and ventilating equipment	12-01 b
Electric lighting and power system	13-01 b
Gasoline-electric standby unit	14-07 b
Traveling crane, complete	15-05
All miscellaneous equipment items designated in Sections X and XVI	

Four copies of each drawing shall be submitted to the contracting officer for approval. Each sheet of drawings submitted for approval shall be provided with a blank white space approximately 5 inches by 4 inches near the lower right-hand corner, just above the title, in which the contracting officer may indicate the action taken. After approval by the contracting officer, but before the work indicated on the contractor's drawings is commenced, one copy of each approved drawing will be furnished the contractor. These approved drawings shall form a part of the contract. The Government will not be responsible for minor errors or minor discrepancies of the contract drawings, nor for errors in the contractor's drawings, even though approved. Drawings furnished by the contractor for approval by the contracting officer shall be made with ink on tracing cloth. Upon completion of the project, the contracting officer shall be furnished with "Van Dyke" negatives of the contractor's drawings, corrected to show all revisions made during construction. Payment for contractor's drawings, revisions thereof, and for copies furnished shall be included in the contract prices for material of work.

1-05. Quantities. - The following estimate of quantities is given to serve as a basis for the comparison of bids and to determine the approximate consideration of the contract. Within the limits of available funds, the contractor will be required to complete the work specified in Paragraph 1-02, whether the required quantities are more or less than the amounts herein estimated, and final payment will not be made until the work is so completed.

Item	Designation	Unit	Quantity
1	Preparation of Site	job	-
2	Unwatering Construction Area	"	-
3	Common Excavation - General	cu. yd.	5,600
4	Common Excavation - Trench	" "	100
5	Common Excavation - Borrow Areas	" "	1,800
6	Gravel Bedding	" "	50
7	Compacted Impervious Backfill	" "	2,000
8	Semi-Compacted Fill	" "	5,500
9	Riprap - Hand-Placed	" "	80
10	DELETED		
11	V. C. Pipe		
	a. 4-Inch	lin.ft.	75
	b. 6-Inch	" "	95
	c. 30-Inch	" "	45
12	Cement	bbl.	1,700
13	Concrete - Class "A"	cu. yd.	1,160
14	Concrete - Class "B"	" "	240
15	Steel Reinforcement	lb.	196,000
16	Pumping Station Superstructure	job	-
17	Miscellaneous Iron and Steel	lb.	14,800
18	Miscellaneous Pipe and Fittings	"	2,800
19	Structural Steel for Service Bridge	"	8,200
20	Steel Trash Racks	job	-

Item	Designation	Unit	Quantity
21	Sluice Gates, Complete with Hoists	job	-
22	Heating and Ventilating Equipment	"	-
23	Electric Light and Power System	"	-
24	Gasoline Electric Standby Unit	"	-
25	Traveling Crane, Complete	"	-
26	Sump Pump	"	-
27	Water Supply and Plumbing Fixtures	"	-
28	Carbon Dioxide Fire Extinguishing Equipment	"	-
29	Drains	"	-
30	Gasoline Tank and Piping	"	-
31	Float Gage	"	-
32	Installing Equipment Furnished by the Government	"	-
33	Seeding	acre	0.5
34	DELETED		
35	DELETED		
36	Highway Guard Posts	job	-
37	Timber Stop-Logs	MFBM	1.02
38	Timber Sheeting	sq.ft.	275

1-06. Physical data. - a. General. - Borings have been made in the vicinity of the proposed work with reasonable care and laboratory analyses have been made of the samples from some of these holes. Samples of materials taken from them, and records of laboratory analyses and results of other studies may be seen at the U. S. Engineer Office, Providence, R. I. It is expressly understood that the Government will not be responsible for any deduction, interpretation, or conclusions made by the contractor from his inspection of available samples and records. These samples of materials and contract drawings represent all the pertinent information on subsurface exploration which the Government has made at the site. Concrete aggregates, riprap and gravel or crushed stone shall be obtained from sources approved by the contracting officer.

b. Transportation facilities. - (1) Railroads. - The New York, New Haven and Hartford Railroad serves the Town of East Hartford with main line traffic. The contractor shall investigate the availability of the sidings from the railroad company and make all arrangements with the latter for the use of any sidings for the delivery of any materials and equipment to be used on the work.

(2) Highways. - First-class highways also serve the Town. The contractor shall provide for his own construction or access roads and their maintenance. He shall make his own investigation of available roads for transportation, of load limits for bridges and roads, and other road conditions affecting the transportation of materials and equipment to the site of the work.

c. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 18 degrees to plus 101 degrees Fahrenheit. The mean annual precipitation at East Hartford is 43.38 inches. The mean monthly precipitation varies from a low of 3.32 inches in June to a high of 4.19 inches in August.

1-07. Commencement, prosecution, and completion. - a. The contractor will be required to commence the work under the contract within ten (10) calendar days after date of receipt by him of notice to proceed, to prosecute the said work with faithfulness and energy, and to complete (1) the concrete conduit construction between Stations 9+17.67 and 10+77.29, (2) the outlet structure to elevation 12.0, (3) placing of compacted impervious backfill to approximately elevation 15.0 and (4) all work necessary to permit diversion of the flow of water from the Swale through the concrete conduit, on or before September 15, 1941; and to complete the entire work, including the installation and testing of equipment in the pumping station (see Section XVII), within 220 calendar days after said date of receipt of notice to proceed.

b. The contracting officer may, in his discretion, suspend work for the period during which sub-freezing temperatures are experienced or are reasonably to be expected, ground moisture conditions are unfavorable, or the water surface in the river exceeds elevation of 15.0 feet at the pumping station site (see Paragraph 3-01 b). The contractor will be required to resume operations on written notice from the contracting officer terminating the suspension, provided that a maximum of 3 days after receipt of notice will be allowed before it becomes effective. The time allowed for completion of the entire work is exclusive of any time that may intervene between the effective date of orders of the contracting officer to suspend operations and the effective date of orders to resume the work.

c. Liquidated damages. - (1) In case of failure on the part of the contractor to complete the work within the time determined and agreed upon for its completion plus any extensions duly granted under the terms of the contract, the contractor shall pay the Government as liquidated damages the following: For failure to complete (1) the concrete conduit construction between Stations 9+17.67 and 10+77.29, (2) the outlet structure to elevation 12.0, (3) placing of compacted impervious backfill to approximately elevation 15.0 and (4) all work necessary to permit diversion of the flow of water from the Swale through the concrete conduit, on or before September 15, 1941, the sum of one hundred dollars ($100.00) for each calendar day of delay; and for failure to complete the entire work under the contract within 200 calendar days, plus any additional time allowed under the terms of the contract, after said date of receipt of notice to proceed, the sum of one hundred dollars ($100.00) for each calendar day of delay until all work is completed or accepted, except as otherwise specified in subparagraph (2) below.

(2) Minor deficiencies in the work and operating deficiencies noted in tests on equipment shall be corrected or adjusted within 30 calendar days after date of completion specified in subparagraph (1) above. The provision for liquidated damages shall not apply to the period of time, not exceeding 30 calendar days, allowed by the contracting officer to correct or adjust the aforesaid deficiencies, but final payment will not be made until such deficiencies have been satisfactorily corrected or adjusted.

1-08. Sundays, holidays, and nights. - No work shall be done on Sundays or on days declared by Congress as holidays for per diem employees of the United States except in cases of emergency, and then only with the written consent of the contracting officer. Work may be done at night when authorized in writing by the contracting officer.

1-09. Progress, organization, and plant. - a. The contractor shall employ at all times, an ample force of men with proper experience in their respective assignments, and provide equipment and a construction plant properly adapted to the work, and of sufficient capacity and efficiency to accomplish the work in a safe and workmanlike manner within the time specified in Paragraph 1-07. All plant and equipment shall be maintained in good working order, and provision shall be made for immediate emergency repairs. The contracting officer may order the removal and require replacement of any unsatisfactory plant or equipment. No reduction in the capacity of the plant employed on the work shall be made, except under written permission of the contracting officer. The measure of "Capacity of the Plant" shall be its actual performance on the work to which these specifications apply. It is understood that award of this contract shall not be construed as a guarantee by the Government that the plant and equipment listed by the contractor in the bid form is adequate for the performance of the work.

b. Should the contractor fail to maintain a rate of progress which will insure completion of the work within the time specified in Paragraph 1-07, the contracting officer may require that additional men, equipment or plant be placed on the work, or a reorganization of plant layout be effected in order that the work be brought up to schedule and maintained there. Should the contractor refuse or neglect to comply with these requirements to the satisfaction of the contracting officer, the contracting officer will proceed under the provisions of Article 9 of the contract.

1-10. Payments and assignments. - a. Payments. - Payments will be made monthly in accordance with Article 16 of the contract, provided that where, in the opinion of the contracting officer, the attendant circumstances are such as to warrant such action, payments may be made semi-monthly, or on a monthly basis other than the calendar month.

b. Assignment of claims. - Claims under this contract may be assigned in accordance with the Assignment of Claims Act of 1940 if payments hereunder will aggregate $1,000 or more, subject to the following added provisions:

(1) Any assignment shall cover all amounts payable under this contract and not already paid and shall not be made to more than one party, except that any such assignment may be made to one party as agent or trustee for two or more parties participating in such financing.

(2) Any claim under this contract which may be assigned may be subject to further assignment to a bank, trust company, or other

financing institution, including any Federal lending agency, and to similar further assignment; provided that any such assignee shall file written notice of the further assignment together with a true copy of the instrument of further assignment with the contractor and also as provided in Proviso 4 of Section of the Assignment of Claims Act of 1940, (Public No. 811, 76th Congress) in respect of original assignment. No assignee shall divulge any information concerning the contract, or contained therein, except to those persons necessarily concerned with the transaction.

(3) Payments to an assignee of any claim arising under this contract shall not be subject to reduction or set off for any indebtedness of the assignor to the United States arising independently of this contract.

1-11. Work covered by contract price. - The contractor shall, under his contract prices, furnish and pay for all material, equipment and labor, except the equipment and materials specified to be furnished by the Government in Paragraphs 1-14, 7-19 and 9-15 b and Section XVII, and all permanent, temporary, and incidental work, furnish all accessories, and do everything that may be necessary to carry out the work specified in good faith, which contemplates everything specified completed, in good working order, of good materials with accurate workmanship, skillfully fitted and properly connected and put together (see Paragraph 1-13).

1-12. Tax adjustments. - The contract price will be considered to include all Federal, State and local taxes imposed prior to the date of opening bids and applicable to the undertaking. If any privilege, sales, gross receipt or other tax (exclusive of taxes on net income or undistributed profits) applicable to the undertaking and payable directly by the contractor, is imposed or changed by Federal or State enactment, then the contract price will be increased or decreased accordingly, and any amount due or chargeable against the contractor as a result thereof will be adjusted on payment vouchers as separate items.

1-13. Material to be furnished by the contractor. - a. The contractor shall furnish all materials and equipment, except as specified in Paragraphs 1-14, 7-19 and 9-15 b, necessary to complete the work to be done under these specifications. The equipment furnished by the contractor and installed in the work covered by these specifications shall conform to the drawings and specifications, and shall also conform to the drawings and data sheets furnished by the contractor if approved by the contracting officer. The cost of unloading and loading, handling, hauling, storing and caring for materials and equipment furnished by the contractor shall be included in the contract prices for the work to which the materials and equipment pertain. All materials, supplies and articles delivered at the site shall be adequately housed or otherwise protected against deterioration and damage.

b. Each major piece of equipment furnished under the contract shall be provided with a substantial nameplate securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, and the principal rating data.

1-14. Equipment to be furnished by the Government. - a. The Government will furnish the following materials and equipment forming part of the pumping station equipment, for the work under these specifications:

(1) Four 30-inch pumps.

(2) One 20-inch pump with electric motor.

(3) Four gasoline engines with silencers and exhaust piping.

(4) Four right-angle gear units.

(5) Intake and discharge piping and valves for all pumps furnished by the Government.

(6) Brass plugs to be set in the concrete as shown on the drawings or as directed.

b. Delivery. - The contractor shall give the contracting officer 30 days' written notice of the quantities, designation and desired delivery dates of materials and equipment required (see Paragraph 17-02). The equipment and materials to be furnished by the Government will be delivered to the contractor f.o.b. railroad cars at East Hartford, Connecticut, or f.o.b. trucks at the site of the work, at the option of the contracting officer, and shall be received and cared for by the contractor in accordance with the provisions of Paragraph 17-02 b whether or not delivery has been previously requested.

1-15. Order of work. - The work shall be carried on at such places and also in such order of precedence as may be found necessary by the contracting officer. The contractor shall submit, for approval of the contracting officer, his proposed program in writing giving the sequence of construction operations contemplated. The location and limits of the work to be done will be plainly indicated by stakes, lines, marks or otherwise as established by the contracting officer or his agents.

1-16. Damage. - Damage to Government property due to the failure of the contractor to take reasonable precaution, and all loss or deterioration of, or damage to any of the work by flood, accident or exposure prior to final acceptance of the work, shall be made good by the contractor without expense to the Government; except that the Government will compensate the contractor for repairs to the permanent work, if damaged by flooding or scouring, through no fault of the contractor, (see Paragraph 3-01 b).

1-17. Patents. - The contractor shall hold and save the Government, its officers, agents, and employees harmless from liability of any nature or kind, including costs and expenses for or on account of any patented or unpatented process or invention, article, or appliance manufactured or used in the performance of this contract, including its use by the Government.

1-18. Grounds and rights of way. - a. Grounds and rights of way needed for the work to be done under these specifications will be furnished by the Government. The Government shall not be held liable for any delay in furnishing the grounds or rights of way, but in case such delay retards the operations of the contract, the contracting officer will grant an extension of time for the completion of the work, equal to the length of the delay (see Paragraph 1-07). The contractor will have the privilege of using the Government-controlled land at the site, not otherwise reserved by the contracting officer provided that plans for all construction, storage, or other operations proposed thereon by the contractor are submitted for approval of the contracting officer prior to the occupation of such areas.

b. The contractor, without expense to the Government, at any time during the progress of the work and when space is needed for other purposes, shall vacate promptly and clean up any part of the grounds allotted to or in use by him, when directed to do so by the contracting officer.

1-19. Removal of rubbish. - The contractor shall keep the site free from rubbish. Suitable spoil areas for receiving refuse from the grounds shall be provided by the contractor and the rubbish shall be removed and disposed of as directed by the contracting officer. At the conclusion of the work, the site shall be cleaned up and all rubbish and unused materials shall be removed.

1-20. Obstruction and danger lights. - In the contractor's use of streets and highways, for the work to be done under these specifications, he shall conduct his operations as approved by the contracting officer and in accordance with State and local laws and regulations. The contractor shall provide, erect and maintain effective barricades, danger signals, and signs on all intercepted roads or highways, and on the site where directed by the contracting officer for the protection of the work and the safety of the public. All barricades, obstructions and plant which encroach on or are adjacent to public rights of way shall be provided with lights at night and all such lights be kept burning between sunset and sunrise. Such barricades and lights shall conform to the local and State laws. The contractor shall be responsible for all damages resulting from any neglect or failure of these requirements. The expenses of these and other safety precautions shall be borne by the contractor.

1-21. Inspection and supervision. - a. General. - The work will be conducted under the general direction of the contracting officer, and will be inspected by inspectors appointed by him who will enforce a strict compliance with the terms of the contract. The contracting officer will furnish on request of the contractor, all location and limit marks reasonably necessary as provided in Paragraph 1-23. The inspectors will keep a record of work done, and see that the location and limit marks are kept in proper order. The presence of an inspector shall not relieve the contractor of his responsibility for the superintendence required in the proper execution of the work (see Article 8 of the contract). Tests to determine the

quality and fitness of material used and work done under these specifications will be made as indicated under that part of the specifications pertinent to the particular kind of work, and as stated in Paragraph 1-37.

b. Facilities to be furnished. - (1) The contractor shall furnish promptly, in accordance with Article 6 of the contract, all facilities, labor, and materials necessary for the safe and convenient inspection and tests that may be required by the contracting officer.

(2) The contractor shall furnish an appropriate room, approximately 12 by 20 feet in size, at his concrete mixing plant for a Government laboratory, to be used for making field tests, including the moisture content of aggregates and such other field tests as are prescribed in these specifications under Section VII and for temporary storage of concrete specimens. The room shall be protected from the weather, properly lighted, and heated, all of which together with the location and capacity shall be subject to the approval of the contracting officer. The contractor shall provide electricity in accordance with Paragraph 1-34.

(3) The contractor shall furnish appropriate quarters for a Government field office. Such quarters shall be a room approximately 12 by 20 feet in size, and otherwise shall conform to the provisions of subparagraph (2) above. If the field office and laboratory are at the same location only one room will be required.

(4) No separate payment will be made to the contractor for providing these facilities. Should the contractor refuse, neglect, or delay compliance with the requirements concerning facilities for inspection and for furnishing the Government field office, the specific facilities may be furnished and maintained by the Government, and the cost therefor will be deducted from any amounts due or to become due the contractor.

c. It is hereby understood and agreed that any instructions or decisions by a superior officer through the contracting officer are to be considered instructions or decisions of the contracting officer in all cases under the terms of the contract where decision rests with the contracting officer.

1-22. Datum and bench marks. - The plane of reference used in these specifications and on the drawings hereof is mean sea level datum. Elevations in feet as specified and as shown on the drawings are to be determined from a bench mark located at the site of the work, the location, description, and elevation of which are as follows:

U.S.G.S. BENCH MARK

T-8 at East Hartford, Hartford County, on the New York, New Haven and Hartford Railroad; 294 feet east of the station, at the bridge over Main Street, in the top of the south end of the west abutment, and 29 feet south of the south rail. A standard disk, stamped "T8 45.33." Elevation 13.769 meters or 45.174 feet mean sea level.

1-23. Lines and grades. - a. The contractor shall keep the contracting officer informed a reasonable length of time in advance of the time and place at which he intends to do work in order that lines and grades may be given, necessary measurements for record and payment made and progress photographs taken with a minimum of inconvenience to the contracting officer or of delay to the contractor, and the contractor shall have no claim for damages or extension of time on account of delays in the giving of lines and grades or due to destruction of such marks and the consequent necessity for replacement.

b. All lines and grades will be given by the Government inspectors as authorized representatives of the contracting officer, but the contractor shall provide at his own expense such temporary structures and such materials and give such assistance as may be required by the contracting officer and the marks given shall be carefully preserved. After lines, elevations and grades for any part of the work have been given by the contracting officer, the contractor will be held responsible for the proper execution of the work to such lines, elevations, and grades, and all stakes or other marks given shall be preserved by the contractor until their removal is authorized by the contracting officer. The contracting officer may require the work to be suspended when for any reason such marks cannot be properly followed.

1-24. Interpretation of specifications. - The contracting officer shall decide all questions which may arise as to the performance, quantity, quality, acceptability, fitness, and rate of progress of the several kinds of work to be done or materials to be furnished under this contract. He shall decide all questions which may arise as to the interpretation of the specifications and of drawings used and as to the fulfillment of this contract on the part of the contractor, and as to defects in the contractor's work. His determination and decision shall be final, subject to approval as provided for in Article 15 of the contract and Paragraph 1-33 of these specifications.

1-25. Water supply. - The contractor shall provide, at convenient points, ample supplies of water of proper quality for all the operations required under this contract.

1-26. Use of explosives. - The contractor shall use the utmost care in the use of explosives necessary for the prosecution of the work, not to endanger life or property. All blasting operations shall be conducted by experienced men only. The handling and use of explosives shall be done strictly in accordance with the latest methods and rulings to insure safety; in accordance with the specifications issued by the U. S. Bureau of Mines; and in compliance with the local and State laws. Failure to observe necessary precautions will be sufficient grounds for temporary suspension of the work. All explosives shall be transported and stored in a secure manner, and in accordance with local and State laws; all vehicles and such storage places shall be marked clearly "DANGER - EXPLOSIVES," and shall be in care of competent watchmen at all times. In no case shall caps or other detonators be stored or transported with dynamite or other explosives. The

locations of magazines for the storage of explosives and for the separate storage of detonators shall be subject to the approval of the contracting officer.

1-27. Standard stock products. - All material, supplies and articles furnished shall, wherever so specified and otherwise wherever practicable, be the standard stock products of recognized reputable manufacturers. The standard stock products of manufacturers other than those specified will be accepted if, in the opinion of the contracting officer, they are equal in strength, durability, usefulness and convenience for the purpose intended. (See Article 7 of the contract.) Any changes required in the details and dimensions shown on the drawings for the substitution of standard stock products, other than those provided for, shall be properly made as approved by the contracting officer, and at the expense of the contractor.

1-28. Safety requirements. - a. The contractor shall make all necessary provisions to protect the public safety, and to maintain and protect existing structures of whatever kind, and shall repair all damages done to such structures. He shall give ample notification to the proper officials of any city or town and of any public utility or other corporation before entering upon their respective public ways or rights of way to perform the required work of construction. Such construction shall conform to the customary regulations and requirements of said officials or corporations. The contractor shall give all notices, take out all permits, and pay all such charges, fees, water and other rates that may be necessary in the carrying out of the work.

b. The contractor shall be responsible that his employees observe the laws of the United States affecting all operations at the site under the contract. He shall comply with all applicable Federal and State laws under which he is operating, including those concerning the inspection of boilers and other equipment, and the licensing of engineers, welders and other employees.

c. The contractor shall conduct the work with due regard to adequate safety and sanitary requirements and shall maintain his plant and equipment in safe condition. He shall conform to current safety engineering practices as set forth in the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America; the publications of the National Safety Council, and with all applicable State or local safety and sanitary laws, regulations and ordinances.

d. The contracting officer will require such safety and sanitary measures to be taken as the nature of the work and the conditions under which it is to be performed, demand. Such measures shall include:

(1) The provision of adequate extinguishers or fire-fighting apparatus in and about all buildings and plant erected or used at the site of the work.

(2) Adequate first aid and life-saving equipment.

(3) Adequate illumination during nithgt operations.

(4) Instruction in accident prevention to reach all employees.

(5) Such machinery guards, safe walkways, scaffolds, ladders, bridges, gang-planks, and other safety devices, equipment, and apparel as are necessary to prevent accidents or injuries.

(6) The provision of watchmen and flagmen at railroad crossings and street intersections where traffic may be affected by the contractor's trucking operations.

e. The contractor shall report promptly to the contracting officer in form prescribed by him all accidents occurring at the site of the work.

f. The contracting officer will notify the contractor in writing of any non-compliance with the foregoing provisions and the corrective action to be taken. If the contractor fails or refuses to comply promptly, the contracting officer may issue a stop order suspending all or any part of the work. Such stop order will be sent by registered mail to the contractor at the site of the work and shall be accepted by him as sufficient notice thereof. Work shall thereupon be suspended as directed. When satisfactory corrective action is taken, a resumption order will be issued. No part of the time lost due to any such stop order shall be made the subject of a claim for extension of time or for excess costs or damages by the contractor.

1-29. Access to work. - The contracting officer, his authorized representative and other duly authorized agents and employees of the Government may at all times enter upon the work and premises used by the contractor, or into his works, or shops. The contractor shall provide safe and proper facilities for such entrance and for the inspection of materials and workmanship.

1-30. Interference with other contractors. - The contractor shall be subject to Article 13 of the contract regarding interference with materials, appliances or employees of the Government or of any other contractor who may have work at the site. As far as practicable, all contractors shall have equal rights to the use of all roads and grounds. In case of disagreement regarding such use, the decision of the contracting officer shall govern, subject to appeal under Article 15 of the contract.

1-31. Purchase of supplies and materials. - a. Preference for domestic articles. - (1) Because the materials listed below or the materials from which they are manufactured are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality,

their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin.

Platinum	Nickel	Asbestos
Chromium	Rubber	China wood oil (tung oil)
Cork	Teakwood	Balsa wood
Jute	Sisal	English ball clay
Kauri gum	Silk	English china clay
Lac	Tin	Natural copper-nickel alloy

(2) Articles, materials, or supplies, manufactured in the United States and containing mercury, antimony, tungsten, or mica of foreign origin may be used (subject to the requirements of the specifications) in the work herein specified, because such manufactured articles, materials, or supplies have been manufactured in the United States, substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States.

b. Purchasing procedure. - Two copies of all purchase orders showing firm names and addresses, and of all shipping bills or memoranda of shipments received showing car initials and numbers, when shipped by railroad, shall be furnished promptly to the contracting officer. Such orders, shipping bills or memoranda shall clearly indicate weights, and shall be so worded or marked that each item, piece or member can be definitely identified on the drawings.

1-32. Minor modifications. - The right is reserved to make such minor changes in the execution of the work to be done under these specifications as, in the judgment of the contracting officer, may be necessary or expedient to carry out the intent of the contract; provided that the unit cost to the contractor of doing the work shall not be increased thereby, and no increase in unit price over the contract rate will be paid to the contractor on account of such changes.

1-33. Claims, protests, and appeals. - a. If the contractor considers any work demanded of him to be outside the requirements of the contract or if he considers any action or ruling of the contracting officer or of the inspectors to be unfair, the contractor shall, without undue delay, upon such demand, action, or ruling, submit his protest thereto in writing to the contracting officer, stating clearly and in detail the basis of his objections. The contracting officer shall thereupon promptly investigate the complaint and furnish the contractor his decision, in writing, thereon. If the contractor is not satisfied with the decision of the contracting officer, he may, within thirty days, appeal in writing to the Chief of Engineers, whose decision shall be final and binding upon the parties to the contract. Except for such protests or objections as are made of record in the manner herein specified and within the time limit stated, the records, rulings, instructions or decisions of the contracting officer shall be final and conclusive.

b. The Chief of Engineers has been designated by the Secretary of War as his duly authorized representative to make final decision and to

take other action where the terms of the contract require that such decision or action shall be "by the head of the department concerned or his duly authorized representative." All appeals from decisions of the contracting officer authorized under the contract shall, therefore, be addressed to the Chief of Engineers, United States Army, Washington, D.C. The appeal shall contain all the facts or circumstances upon which the contractor bases his claim for relief and should be presented to the contracting officer for transmittal within the time provided therefor in the contract.

1-34. Electric power to be furnished by the contractor. - The contractor shall make arrangements for, shall pay for, and furnish all necessary power to carry on the work, including sufficient power for lighting and other miscellaneous uses in buildings furnished by the contractor for Government use during the life of the contract. No separate payment will be made to the contractor for the power furnished.

1-35. Rate of wages. - a. In accordance with Article 17 of the contract, the minimum wages shown in the following schedule, as approved by the United States Department of Labor, shall be the minimum rates of wages to be paid by the contractor for work under this contract. Corresponding rates for occupations not listed below will be furnished upon application by the contractor.

Designation	Wage Rate - Hourly
Blacksmiths	$1.00
Bricklayers	1.375
Carpenters, journeymen	1.25
Cement finishers	1.375
Electricians	1.25
Electrician's apprentices	.75
Firemen, 15 lbs. or over	.80
Firemen, under 15 lbs.	.65
Jackhammermen	.75
Laborers, unskilled	.50
Laborers, building	.75
Mason tenders	.875
Mechanics, repairmen	1.00
Oilers	.65
Painters	1.125
Painters, structural steel	1.50
Plumbers	1.375
Plumbers' helpers	.65
Reinforcing rod setters	1.65
Riggers (derrick)	1.65
Sheet metal workers	1.25
Steam fitters	1.375
Steam fitters' helpers	.65
Structural iron workers	1.65

Designation	Wage Rate - Hourly
Operators of power equipment:	
Air compressors	$1.30
Concrete mixers, less than 5 bags	.75
Concrete mixers, 5 bags or over	.85
Cranes, derricks, draglines	1.50
Hoists, 1 drum	1.30
Hoists, 2 or more drums	1.65
Piledrivers	1.50
Pumps (mechanical)	.65
Rollers	.90
Shovels, 1/2 yd. or less	1.30
Shovels, over 1/2 yd.	1.50
Tractors, under 50 h.p.	.75
Tractors, 50 h.p. or over, with attachments	1.30
Truck drivers, 2 tons or under	.60
Truck drivers, over 2 tons	.68

b. Any class of laborers and mechanics not listed above, which will be employed on the work, will be classified or reclassified by the contracting officer to conform to the foregoing schedule. In the event of disagreement between the contracting officer and the contractor as to such classification or reclassification, the question accompanied by the recommendation of the contracting officer, will be referred to the United States Department of Labor for final determination.

c. The above list of wages shall be posted by the contractor in a conspicuous place on the work.

1-36. Reports to Department of Labor. - The contractor shall report, and shall cause all subcontractors to report in like manner, within 5 days after the close of each calendar month, on forms to be furnished by the Department of Labor, the number of persons on their respective payrolls, the aggregate amount of such payrolls, the man-hours worked, and the total expenditures for materials. He shall furnish to the Department of Labor the names and addresses of all subcontractors on the work at the earliest date practicable, provided that the foregoing shall be applicable only to work at the site of the construction project.

1-37. Standard tests, qualities and guarantees. - a. All materials, supplies and parts and assemblies thereof, entering into the work to be done under these specifications, shall be tested as specified, or otherwise required, in conformity with the best modern approved methods for the particular type and class of work.

b. Unless waived in writing by the contracting officer, all tests and trials shall be made in the presence of a duly authorized representative of the contracting officer. When the presence of the inspector is so waived, sworn statements, in duplicate, of the tests made and the results thereof, shall be furnished to the contracting officer by the contractor.

c. Costs of all tests and trials, excepting (1) the expense of the Government inspector, (2) cement, concrete aggregate and cylinder tests, and (3) tests on embankment materials, shall be borne by the contractor and shall be included in the contract price. (See Paragraph 7-11.)

d. All materials, parts and equipment shall be of the highest grade, free from defects and imperfections, of recent manufacture, new and unused. Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

1-38. Protection of existing structures. - During construction operations, on work covered by these specifications, the contractor shall protect all existing structures and accepted work. Any disturbances or damage to any structures by operations under these specifications shall be repaired promptly by the contractor without cost to the Government.

1-39. Final acceptance and payment. - As soon as practicable after the completion of the entire work, the contracting officer will make a thorough examination of same and if it is found to comply fully with the requirements of the specifications, it will be accepted, and final payment will be made in accordance with Article 16 of the contract.

1-40. Approval. - This contract shall be subject to the written approval of the Division Engineer, North Atlantic Division, and shall not be binding until so approved.

SECTION II. PREPARATION OF SITE (Item 1)

2-01. Work included. - Clearing, grubbing, and disposal of materials shall be done as directed by the contracting officer.

2-02. Clearing. - a. Clearing shall include all necessary portions of the following areas: (1) The areas within the working limits of the foundations of the proposed structures and fills, and (2) any other area designated by the contracting officer within the limits of the work.

b. Trees and rubbish shall be removed by the contractor from the sites of the proposed structures and fills, when and as directed by the contracting officer, and may be removed from other areas only to the extent directed or permitted. The contractor shall preserve and protect from injury all trees not required to be removed.

2-03. Grubbing. - The foundation areas of the concrete structures and fills shall be thoroughly grubbed of all stumps, roots, buried logs, and other objectionable matter.

2-04. Removal of structures. - The removal of existing structures and utilities required to permit the orderly prosecution of the work covered by these specifications shall be accomplished by local agencies unless otherwise shown on the drawings. Whenever a telephone or telegraph pole, pipe line, conduit, fence, sewer or other utility is encountered and must be removed to permit completion of the work, the contracting officer will notify the proper local authorities, and the designated utility will be removed promptly.

2-05. Disposal of materials. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas as directed. No material shall be thrown into, or left along the bank of, the river. The disposal of material shall closely follow the operations of clearing. At no time shall material be placed on land adjacent to the construction area. No damage of any nature shall be inflicted upon adjoining property owners by unwarranted entry or disposal of material on adjacent property.

2-06. Payment. - Payment for all work in connection with the preparation of the site as above specified, including the loading, hauling, and disposal of the materials, will be made at the contract price for Item 1, "Preparation of Site".

SECTION III. UNWATERING CONSTRUCTION AREA (Item 2)

3-01. Work included. - a. All permanent construction shall be carried on in areas free from water unless otherwise authorized by the contracting officer. Special care shall be taken to prevent the foundation areas of the proposed structures and fills from becoming unstabilized by flow of ground water into the excavations. Where excavation extends below existing ground water level the contractor shall lower the elevation of ground water, by the use of well points or other approved means, a minimum of two feet below the bottom of the excavation and in advance of the excavation operations for the pumping station, intake, outlet structures and outlet conduit. The ground water level shall be maintained two feet below the lowest excavation elevation until sufficient concrete has been placed in the base and walls, as determined by the contracting officer. The contractor shall install, and maintain in good working order, not less than three observation wells of 2-inch pipe as approved by the contracting officer. Necessary shoring, sheeting and pumping, and clearances for the permanent work shall be provided for (see Paragraph 4-01 d (4) and 4-03 d).

b. If the water surface rises above Elevation 15.0 at the pumping station site and causes damage to the permanent work, during the period of the contract, such damage shall be repaired by the contractor and will be paid for by the Government at the applicable contract unit prices (see Paragraph 1-16).

c. The contractor shall maintain existing operating sewers during construction so that their discharges are unimpeded, and shall divert the water away from the permanent construction by flumes or otherwise as directed by the contracting officer.

d. The contractor shall provide an adequate bulkhead suitable for placing in the completed concrete conduit, approximately at the location of the proposed outlet structure, to prevent river flood water from entering the protected area through the concrete conduit. The bulkhead shall be available for use from October 15, 1941 up to the time of installing the permanent gate and shall be built to withstand the head of water equivalent to a stage of Elevation 34.0 in the Hockanum River. The contractor will be required to close the temporary bulkhead when the stage in the river exceeds Elevation 12.0 or whenever directed by the contracting officer.

3-02. Cofferdam protection.- Any suitable type of cofferdam may be used subject to the approval of the contracting officer. The contractor shall be responsible for the adequacy of the cofferdam protection, and for any damage resulting from failure or washing out of cofferdams. Subject to the approval of the contracting officer, materials excavated from the work shown on the drawings may be used for constructing cofferdams.

3-03. Maintaining existing sewers. - Provisions shall be made to maintain the satisfactory operation of existing sewers throughout the construction period, unless otherwise authorized by the contracting officer. The contractor shall install temporary sewer extensions and connections, including valves and specials, necessary to divert the water away from the work. The installation of temporary sewer extensions and connections shall include all shoring, excavation, backfilling and other incidental work required in connection therewith.

3-04. Pumping and draining. - Before beginning work within the cofferdams, the water shall be diverted and the construction areas shall be unwatered, and shall be kept free from water throughout the working period, unless otherwise authorized by the contracting officer.

3-05. Removal of cofferdams and temporary sewer connections. - When the work is finished within the cofferdams or when the need for the cofferdams and temporary sewer connections no longer exists, the temporary protection works, bulkheads and sewer connections shall be removed to spoil areas or otherwise disposed of as approved by the contracting officer.

3-06. Payment. - The contract price for Item 2 shall include payment for control of water during construction, observation wells, the construction, maintenance, rebuilding in case of destruction, unwatering and removal of cofferdams, construction and removal of temporary sewer connections, bulkheads and maintenance of unobstructed flow through the existing sewers encountered in the work. Payment will be made in one sum at the contract price for Item 2, "Unwatering Construction Area", when, in the opinion of the contracting officer, the permanent construction no longer requires the protective measures specified under Item 2, and when such protective measures have been removed to the satisfaction of the contracting officer.

SECTION IV. EXCAVATION (Items 3 to 5, incl.)

4-01. General provisions. - a. Scope of work. - The location and character of the proposed structures, and the location and logs of borings are shown on the drawings (see Paragraph 1-04). It is the intent of the Government that excavation be made to the lines and grades given thereon but the right is reserved to modify any part of the work if, in the opinion of the contracting officer, conditions require such modification (see Articles 3 and 4 of the contract).

b. Disposal of material. - Material from the excavations suitable for fill and backfill shall be stockpiled and used in the permanent construction as directed by the contracting officer. Materials from the required excavations not suitable for use in the permanent construction shall be wasted in spoil areas in approved locations as directed by the contracting officer. After completion of the excavation, spoil areas shall be graded and dressed neatly to the satisfaction of the contracting officer.

c. Measurement. - (1) Excavation will be measured in place and the volume thereof will be computed between the original ground surface as determined by a survey made just prior to the commencement of the work and the pay lines shown on the drawings.

(2) Where pay lines are not shown on the drawings, measurement will be made of the volume between the original surface as determined from the survey made just prior to the commencement of the work and the lines and grades established by the contracting officer.

d. Payment. - (1) Items included. - The contract prices for the various classes of excavation shall include the cost of all labor, plant and incidental costs for excavating, loading, hauling and disposal of the material in the fill, backfill or spoil areas, including any stockpiling and rehandling, and the grading and dressing of spoil areas.

(2) Construction roads. - The construction and maintenance of roads and bridges for the contractor's use will not be paid for as such but the cost thereof shall be included in the contract prices for the other items of work.

(3) Pay lines. - Payment for all structure excavations will be made to the pay or slope lines shown on the drawings regardless of whether or not it is necessary to remove the material to slopes greater or less than those shown. No payment will be made for excavation outside of the limits described above, and the contractor will be required to backfill any such excess excavation with approved material, or with additional concrete where excess excavations are adjacent to concrete structures, at his own expense.

(4) Shoring. - Where approved by the contracting officer, shoring may be used in lieu of excavation to the slope or pay lines shown on the drawings. The contractor shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while making structure excavations. Shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford ready inspection of and ample clearance for the permanent work. Shoring shall be removed upon completion of the permanent work or as soon as the construction does not require its use. No payment will be made for temporary shoring, but the cost thereof shall be included in the contract price for the excavation. Measurement for payment for excavation will be made to the pay lines specified in Paragraph 4-01 d (3).

(5) Temporary drains. - The contractor shall maintain the site of the work and adjacent grounds in a well-drained condition. Temporary drains and ditches required shall be constructed by the contractor at his own expense.

(6) Additional payments. - Additional payment will be made as specified in Paragraph 3-01 b to replace portions of the river bank and dike washed out by flooding or scouring, or that required to be removed on account of slides, or the removal and disposal of all objectionable materials; provided such replacement of material was not caused by negligence of the contractor. Quantities for additional payment will be measured as directed by the contracting officer.

4-02. Classification. - All materials excavated will be classified as follows:

a. Common excavation - general shall include the removal of all materials to the lines and grades shown on the drawings or established by the contracting officer.

b. Detailed classification is as follows:

(1) Common Excavation - General (Item 3)(see Paragraph 4-03).

(2) Common Excavation - Trench (Item 4)(see Paragraph 4-04).

(3) Common Excavation - Borrow Areas (Item 5)(see Paragraph 4-05).

4-03. Common excavation - general (Item 3). - a. Work included. - The contractor shall excavate and dispose of the materials classified as common excavation - general, above and below the mean water level in the river to the lines and grades shown on the drawings for the respective areas, or as otherwise directed by the contracting officer. Excavation shall be performed in accordance with a schedule of operations to be approved by the contracting officer. Common excavation - general includes excavation for the foundation of the pumping station and any other required common excavation for structures and drains not included in other items of the work (see Paragraph 3-01 c).

b. Description. - Excavations shall be made wide enough to permit proper sheeting, bracing and form work where necessary. Foundations for the concrete structures shall be excavated as directed by the contracting officer to suitable undisturbed foundation material approved by the contracting officer.

c. Shoring. - See Paragraph 4-01 d (4).

d. Sheeting and pumping. - The contractor shall provide all necessary pumps to unwater the site properly and to keep the site free from water during such time as the work is under construction. The contractor shall provide all labor and materials required to keep the site unwatered during the course of construction, and shall provide all necessary sheeting, bulkheads, sumps, drains, etc., to prevent running water from coming in contact with newly placed concrete or concrete being placed (see Section III).

e. Disposal of materials. - The provisions of Paragraph 4-01 b shall apply. Excavated material not used in permanent construction may be used in temporary construction is approved by the contracting officer. Materials for backfill (see Paragraphs 5-03 and 5-04) shall be stockpiled in the vicinity of the work for later use.

f. Measurement and payment. - Measurement for excavation work under Item 3 will be made as specified in Paragraph 4-01 c. Payment for all work in connection with excavation under Item 3, including the loading, hauling, and disposal of the materials, will be made at the contract unit price for Item 3, "Common Excavation - General".

4-04. Common excavation - trench (Item 4). - a. Work included. - The contractor shall excavate and dispose of the materials in the trench for the vitrified clay pipe and at the seep rings, both above and below the mean water level in the river, to the lines and grades shown on the drawings, or as otherwise directed by the contracting officer. The lines and grades shown on the drawings shall include any necessary adjustment to field conditions.

b. Pumping and draining. - The contractor shall do all pumping and draining necessary to perform the excavation in the dry, and to keep the trench unwatered until it has been satisfactorily backfilled with suitable material.

c. Disposal of materials. - The provisions of Paragraph 4-03 e shall apply.

d. Measurement and payment. - Measurement for excavation work under Item 4 will be made as specified in Paragraph 4-01 c. Payment for all work in connection with excavation under Item 4, including the loading, hauling and disposal of the materials, temporary protection, bulkheads and drains, will be made at the contract unit price for Item 4, "Common Excavation - Trench".

4-05. Common excavation - borrow areas (Item 5). a. Work included. - The contractor shall excavate, in the indicated borrow areas or other approved areas, the additional materials required to be used in the compacted impervious backfill or semi-compacted fill. Excavation shall include the transportation of the material to the point of disposal. Borrow areas shall be stripped of all objectionable topsoil containing roots or other debris, and any other objectionable material designated by the contracting officer. To provide suitable fill and backfill materials, excavations shall be made to the depths and in the locations as directed by the contracting officer. During and after excavation, the borrow areas shall be graded so that all surface water will drain readily from them. Upon completion of excavation, the borrow areas shall be dressed smoothly and evenly, left in a neat condition satisfactory to the contracting officer, and shall be graded so that the slopes blend into the surrounding topography.

b. Disposal of materials. - Materials from stripping shall be disposed of as provided in Paragraph 4-01 b. Materials from common excavation shall be placed in the permanent work or elsewhere as directed by the contracting officer.

c. Measurement and payment. - Measurement for excavation work under Item 5 will be made as specified in Paragraph 4-01 c. Payment for all work in connection with excavation under Item 5, including the loading, hauling, stockpiling, rehandling and disposal of the materials, temporary protection, bulkheads and drains, unwatering and shoring, will be made at the contract unit price for Item 5, "Common Excavation - Borrow Areas".

SECTION V. MISCELLANEOUS FILLS (Items 6 to 8, incl.)

5-01. General. - "Gravel Bedding", Item 6, will be required immediately underlying the riprap and intake structure apron as shown on the drawings. "Compacted Impervious Backfill", Item 7, is backfill required at the conduit structure as shown on the drawings. "Semi-Compacted Fill", Item 8, is required around miscellaneous structures and berm as shown on the drawings.

5-02. Gravel bedding (Item 6). - a. Work included. - The contractor shall place a layer of gravel or crushed stone upon which riprap will be placed and elsewhere at the locations shown on the drawings and as directed by the contracting officer.

b. Materials. - (1) Gravel bedding shall consist of suitable coarse clean gravel satisfactorily graded within the specified limits and unless otherwise directed, not more than ten percent by weight shall pass a sieve having 10 meshes to the inch, 20 to 60 percent shall pass a sieve having 4 meshes to the inch, and all shall pass a 1-1/2-inch square mesh screen. The material shall be approved by the contracting officer before delivery is made to the site of the work.

(2) Subject to the approval of the contracting officer, crushed stone may be used in place of gravel. Crushed stone shall consist of angular fragments of uniform quality throughout, free from soft or disintegrated stone, dirt or other objectionable matter. The stone shall be uniformly graded within the specified limits. Unless otherwise directed, not more than 2 percent by weight shall pass a sieve having 100 meshes to the inch, 5 to 35 percent shall pass a sieve having 20 meshes to the inch, 50 to 80 percent shall pass a sieve having 4 meshes to the inch, and all shall pass a 1-inch square mesh screen. The material shall be approved by the contracting officer before delivery is made to the site of the work.

c. Placing. - The material shall be placed as shown on the drawings or as directed, and with such hand placing as may be necessary to trim to the required slopes. The contractor will not be required to tamp or roll the material, but may consolidate it with water to the extent directed, so that no settlement will later result.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of gravel or crushed stone furnished and placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Payment for all work in connection with gravel bedding will be made at the contract unit price for Item 6, "Gravel Bedding".

5-03. Compacted impervious backfill (Item 7). - a. Work included. - The contractor shall place, grade, and consolidate materials required for compacted impervious backfill of the conduit structure, and elsewhere as directed.

b. Materials. - Materials shall be obtained from borrow areas, stockpiles of excavated materials (see Paragraph 4-01 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials.

c. Placing. - (1) The backfills shall consist of materials suitable for the purpose as determined by the contracting officer, and shall be placed in successive layers of not more than 8 inches in depth for the full width of the cross section. Each layer shall be compacted thoroughly with a crawler type tractor weighing not less than 20,000 pounds. A minimum of four passes of the tractor treads on each square foot of backfill area will be required for satisfactory compaction. Portions of the backfill area which the compacting equipment cannot reach for any reason shall be thoroughly compacted in 4-inch layers by tamping with power tampers. The compaction for such portions of the backfill shall be equivalent to that obtained by compacting with tractor equipment.

(2) Where backfill is to be placed against only one side of a concrete wall or other structure, no backfill material shall be placed until the concrete has been in place at least 10 days and then only by hand or by trucks or bulldozers operating not closer to the wall than the height of the wall above the foundation. No backfill shall be compacted, nor placed by dragline, clamshell, or other equipment which drops the material in relatively large quantities, nor spread by equipment operating closer to the wall than the height of the wall, until the concrete has been in place at least 14 days.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of compacted impervious backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing compacted impervious backfill will be made at the contract unit price for Item 7, "Compacted Impervious Backfill".

5-04. Semi-compacted fill (Item 8). - a. Work included. - The contractor shall place, grade, and consolidate materials required for semi-compacted fill at the locations shown on the drawings and elsewhere as directed.

b. Materials. - Materials shall be obtained from borrow areas, stockpiles of excavated materials (see Paragraph 4-01 b), or may be obtained directly from required excavations. Fill material shall be free from stumps, roots, and rubbish, or other unsuitable materials or substances.

c. Placing. - The fills shall consist of materials suitable for the purpose as determined by the contracting officer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross section. Each layer shall be consolidated with water or otherwise compacted to the extent directed so that no settlement or voids will later result. See Paragraph 5-03 c (2).

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of semi-compacted fill placed in the completed work to the lines and grades shown on the drawings or as directed by the contracting officer. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing semi-compacted fill will be made at the contract unit price for Item 8, "Semi-Compacted Fill".

SECTION VI. RIPRAP AND DRAINS
(Items 9 to 11 incl.)

6-01. General. - "Riprap - Hand-Placed," Item 9, is required for paving of the intake and outlet channels as shown on the drawings. V. C. Pipe, Item 11 is required for drainage as shown on the drawings. (Item 10 deleted, see Paragraph 1-05.)

6-02. Riprap (Item 9). - a. Work included. - Hand-placed riprap shall be placed, to the lines and grades shown on the drawings, for paving the inlet and outlet channels and elsewhere as required by the contracting officer.

b. Materials. - Riprap shall be of durable rock of acceptable sizes, with a specific gravity of not less than 2.65. Riprap shall be approved by the contracting officer before delivery to the site of the work. Rock for riprap shall be angular and of uniform shape so as to furnish a reasonably smooth, even surface. Not more than 5 percent by weight of the rock shall be smaller than one-half cubic foot in volume and at least 75 percent of the rock used shall be from 1 to 2 cubic feet in volume with one dimension approximately equal to the depth of the riprap course.

c. Placing. - The riprap shall be laid to the lines and grades shown on the drawings or as directed. A tolerance of 3 inches above or below the slope line shown on the drawings will be allowed for the finished slope surface of the hand-placed riprap. The rock shall be closely laid on a base of gravel or crushed stone bedding (see Paragraph 5-02), with the dimension approximately equal to the depth of the course normal to the slope, and with joints broken where possible. The rock shall be roughly squared to minimize voids resulting from abutting undercut faces. The joints on the surface of the riprap shall be filled with tightly driven spalls. Large rock shall be well bedded at the edges of the riprap to prevent undermining.

d. Measurement and payment. - The quantity to be paid for under Item 9 will be the number of cubic yards of riprap satisfactorily placed in the completed work to the specified or ordered lines and grades. The contract unit price shall include payment for furnishing, hauling, and placing the riprap. Payment will be made at the contract unit price for Item 9, "Riprap - Hand-Placed."

6-03. V.C. Pipe (Item 11). - a. Work included. - The contractor shall furnish and lay the vitrified clay pipe, including specials, of the required diameters for the drainage system adjacent to the dike and elsewhere as shown on the drawings or as directed. The contractor shall connect the drains as shown on the drawings.

b. Materials. - (1) All pipes shall be bell-and-spigot, vitrified clay pipe conforming to the requirements of Federal Specification

SS-P-361, or subsequent amendments or revisions thereof. Each pipe shall be carefully inspected immediately before laying and no cracked, broken or otherwise imperfect pipe shall be used, except for minor defects which, in the opinion of the contracting officer, do not impair the fitness of the pipe for the purpose intended.

(2) Subject to the approval of the contracting officer, non-reinforced concrete pipe conforming to the provisions of the A.S.T.M. C14-35 standard specifications for concrete sewer pipe may be substituted for V.C. Pipe in the 4-inch and 6-inch sizes, and reinforced concrete pipe conforming to Federal Specification SS-P-371 may be substituted for V. C. Pipe in the 30-inch size. The provisions of subparagraph (1) above, specifying inspection and selection of pipe, shall apply.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 4-04. Pipe trenches shall have a depth of not less than 2 feet and a width at least 1 foot greater than the outside diameter of the pipe. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom as shown on the drawings. Where encountered, rock or boulders shall be removed to a depth sufficient to clear the under side of the pipe and the voids backfilled with well compacted suitable material.

d. Laying pipe. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded, and properly connected and jointed. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipe shall be laid true to the lines and grades shown on the drawings or as staked in the field with bells upgrade and with spigot ends fully entered in the bells. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall meet the requirements of Paragraphs 7-05 and 7-06. The spigots shall be centered in the bells, and there shall be no shoulders or unevenness of any kind along the invert of the pipes. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout to center the pipe. The mortar shall be thoroughly troweled in the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. Mortar joints shall be protected from the sun by a covering of wet burlap or moist earth over the top third of the pipe. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar and other obstructions.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraph 5-04, unless otherwise shown on the drawings or directed by the contracting officer.

f. Measurement and payment. - (1) Measurement for payment will be based on the linear feet of pipe installed. Payment for pipe will be made at the applicable contract unit prices for Items 11a, 11b and 11c, "V.C. Pipe" for the various sizes installed, and shall include all costs of furnishing and installing the pipe, including specials, and other required materials, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 4 (see Paragraph 4-04 d). Payment for earth backfill will be made at the contract unit price for Item 8 (see Paragraph 5-04 d).

SECTION VII. CONCRETE (Item 12 to 15 incl.)

COMPOSITION, CLASSIFICATION, AND STRENGTH

7-01. Composition. - Concrete shall be composed of cement, fine aggregate, coarse aggregate, and water so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements under this section, and suitable to the specific conditions of placement.

7-02. Classification. - Except where required to meet special conditions all concrete shall be either Class "A" or Class "B", as designated in Section VIII and on the drawings for the various parts of the work in accordance with the conditions of application and the proportions of materials and strengths required.

7-03. Strength. - The mixes will be designed to secure concrete having at least the following compressive strengths at the age of 28 days, as determined by breaking standard 6-inch diameter by 12-inch height or 8-inch diameter by 16-inch height test specimens:

Class.	Average for any 25 consecutive cylinders	Minimum for any one cylinder
A	3400 lbs. per sq. in.	2600 lbs. per sq. in.
B	3000 lbs. per sq. in.	2200 lbs. per sq. in.

7-04. High-early-strength concrete. - High-early strength concrete made with high-early-strength Portland cement or other special cements shall be used only when specifically authorized by the contracting officer. The 7-day compressive strength of concrete of any class, when made with high-early-strength cement, shall be at least equal to the specified minimum 28-day compressive strength for that class. All provisions of these specifications, except for cement, shall be applicable to such concrete. Any high-early-strength cement used shall be approved by the contracting officer before use.

MATERIALS

7-05. Portland cement (Item 12). - a. The contractor shall furnish Portland cement of the quality herein specified in sufficient quantity for the work required. Cement for all concrete, grout and mortar, except as specified in subparagraph b, shall conform to Federal Specification SS-C-206, for "Cement, Portland, Moderate-Heat-of-Hardening, September 30, 1936," except that Paragraph E-7, Heat of Hydration, shall be considered inoperative.

b. High-early-strength Portland cement. - Cement for high-early-strength concrete shall be in accordance with Federal Specification SS-C-201 for "Cement, Portland, High-Early-Strength."

c. Special test requirements. - Cement will be tested by the Government at the Central Concrete Laboratory, West Point, N. Y. No cement shall be used until notice has been given by the contracting officer that the test results are satisfactory. Cement which has been stored, other than in bins at the mills, for more than 4 months after being tested shall be retested before use. Ordinarily, no cement shall be used until after it has satisfactorily passed both the 7- and 28-day tests, but in cases of emergency the contracting officer may waive the 7- and the 28-day tests and permit the use of satisfactory cement upon completion of the chemical analysis and the 3-day compressive strength test; provided it is the product of a quarry and mill having established a reputation of not less than 3 years' standing for the production of high-grade cement. If the tests prove any cement unsatisfactory, which has been delivered at the site of the work, such cement shall be removed promptly from the work and its vicinity.

d. Identification. - Cement shipped in bags shall be identified by the manufacturer by marking or tagging the bags with the identifying number or symbol of the Federal Specification under which it was manufactured. Bulk shipments of cement shall be likewise identified by a suitable device affixed to each car or other type of bulk carrier. Marking or tagging shall be done at the mill.

e. Quality and packages. - All cement shall be dry, finely ground, and free from lumps or caking. Unless otherwise permitted, the cement shall be delivered in canvas bags or other strong, well-made packages, each plainly marked with the manufacturer's brand. The weights of such bags shall be uniform. Packages received in broken or damaged condition will be rejected or accepted only as fractional packages. Cement shall be stored in a satisfactory manner so as to be unaffected by moisture, keeping each carload separate until the results of the 28-day tests are known. Suitable accurate scales shall be provided by the contractor for weighing bulk cement.

f. Records of cement used. - The contractor shall furnish to the contracting officer, at the end of each day's work, a statement showing, in such detail as he may reasonably require, the quantity of cement used during the day at each part of the work.

7-06. Fine aggregate. - a. Composition. - Fine aggregate shall be natural sand.

b. Quality. - Fine aggregate shall consist of hard, strong, durable and uncoated particles.

c. Grading. - (1) Except as provided in (2) below, fine aggregate shall conform to the following requirements:

Total passing	Percent by weight
No. 4 sieve	95 - 100
No. 16 sieve	45 - 75
No. 50 sieve	10 - 25
No. 100 sieve	1.5 to 7

(2) Deficiencies in the percentage of fine aggregate passing #50 and #100 sieves, as required in the above gradation, may be remedied by the addition of pozzuolanic or cementitious materials, excepting Portland cement; provided, at least 5 percent passes the #50 sieve and the aggregate is of proper consistent gradation within the specified limits. Such added material, which will be considered and included as fine aggregate, shall conform to the requirements in Paragraph 7-08 and shall be in sufficient quantity to meet the minimum requirements above for percentage passing #100 sieve and otherwise to produce the workability required by the contracting officer. The quantity and characteristics of any material used for the purpose of correcting workability shall be such that when the concrete is gaged to the proper consistency, the total water content shall not exceed by more than one gallon per cubic yard the minimum quantity required for proper consistency when not using the admixture. The blending of any material with the original naturally graded sand to remedy deficiency in gradation shall be accomplished in charging the mixer, unless otherwise specifically authorized by the contracting officer.

d. Deleterious substances. - The substances designated shall not be present in excess of the following amounts:

	Percent by weight
Clay lumps	1
Material removed by decantation from aggregates	3
Shale	0.5

e. Mortar strength. - Mortar specimens made with the fine aggregates shall have a compressive strength at 28 days of at least 90 percent of the strength of similar specimens made with Ottawa sand having a fineness modulus of 2.40± 0.10.

f. Tests. - Fine aggregate shall be subject to careful, thorough analyses, including magnesium sulphate soundness tests (see Paragraph 7-07 d), to determine conformity with all requirements of these specifications.

7-07. Coarse aggregate. - a. Composition. - Coarse aggregate shall be washed gravel, crushed stone or any approved mixture of washed gravel and crushed stone.

b. Quality. - Coarse aggregate shall consist of hard, tough and durable particles free from adherent coating. It shall contain no vegetable matter, nor soft, friable, thin or elongated particles in quantities considered deleterious by the contracting officer. The substances designated shall not be present in excess of the following amounts (by weight):

Soft fragments	5%
Clay lumps	1/4%
Removed by decantation	1%

When the material removed by decantation consists essentially of crusher dirt, the maximum amount permitted may be raised to 1-1/2 percent. When crushed stone is used, the crusher shall be equipped with a screening system which will entirely separate the dust from the stone and convey it to a separate bin. Aggregate which has disintegrated or weathered badly under exposure conditions similar to those which will be encountered by the work under consideration shall not be used.

c. Size. - (1) Coarse aggregate shall be well graded from fine to coarse so that concrete of the required workability, density, and strength can be made without the use of an excess amount of sand, water, or cement.

For Class "A" concrete, required for Item 13, the maximum size mesh screen for the aggregate shall be 1 inch.

For Class "B" concrete, required for Item 14, the maximum size mesh screen for the aggregate shall be 2 inches.

(2) When the maximum size mesh screen is greater than 1 inch, the aggregate shall be separated, and the specified sizes delivered separately to individual proportioning hoppers, in accordance with the following:

For Maximum Size Mesh screen, 1 in. to 2 in. inclusive:

(1) No. 4 to 1/2 maximum size mesh screen, inclusive.

(2) Over 1/2 maximum size to and including full maximum size mesh screen.

Within any of the above-indicated size limits, not less than 85 percent of the material shall be retained on a standard square mesh screen of the minimum size indicated and not more than 5 percent shall be retained on a standard square mesh screen of the maximum size indicated.

(3) The grading of the coarse aggregate, in the mixed concrete, shall fall within the following limits:

Passing -	Percent by weight
Maximum size mesh screen (square mesh)	97 - 100
1/2 maximum size mesh screen(square mesh)	40 - 70
No. 4 sieve	0 - 6

d. Tests. - Coarse aggregate will be subjected to freezing and thawing tests and to careful, thorough analyses to determine conformity with all requirements of these specifications. Coarse aggregate will be subjected to 10 cycles of the magnesium sulphate tests for soundness (A.S.T.M. C 88-41 T). No aggregate shall be used which develops a loss in excess of 10 percent by weight.

7-08. Material added for workability. - a. The use of any material added to the mix to improve workability (see Paragraph 7-06 c(2)), which, in the opinion of the contracting officer, may have an injurious effect on the strength, density, and durability of the concrete, will not be permitted. Before approval of any material, the contractor will be required to submit the results of complete chemical and sieve analyses made by an acceptable testing laboratory. Subsequent tests will be made of samples taken by the contracting officer from the supply of the material being used on the work to determine whether it is uniform in quality with that approved.

b. The material added shall be pozzuolanic, cementitious or silicious. It shall not contain effective early-heat-producing elements or compounds, such as those contained in Portland cement, nor shall its use result in a material increase in the free-lime content of the concrete. It shall also be in conformity with the following requirements:

Free moisture - a total of not more than 3 percent by weight.
Passing #30 sieve - not less than 100 percent by weight.
Passing #200 sieve - not less than 85 percent by weight.

7-09. Water. - The water used in mixing concrete shall be fresh, clean, and free from injurious amounts of oil, acid, alkali, or organic matter.

7-10. Storage. - a. Cement. - Immediately upon receipt at the site of the work, cement shall be stored in a thoroughly dry, weathertight, and properly ventilated building with adequate provisions for the prevention of the absorption of moisture. The building shall be of adequate capacity to provide for the requirements of delivery and construction schedules. Storage shall be such as to permit easy access for inspection and definite identification of each shipment.

b. Aggregates. - The fine and coarse aggregates shall be stored separately (see Paragraph 7-07 c(2)) and in such manner as to avoid the inclusion of any foreign material in the concrete. Stockpiles of coarse aggregates shall be built in horizontal layers to avoid segregation.

7-11. Sampling and testing aggregates. - Except where provided otherwise by these specifications, all sampling and testing of aggregates shall be made in accordance with the Federal Specifications. Unless specified otherwise, all test samples shall be taken under the supervision of the contracting officer and supplied to the Central Concrete Laboratory, West Point, N. Y., by the contractor at his expense. The source from which concrete aggregates are to be obtained shall be selected by the contractor well in advance of the time when they will be required in the work, and suitable samples as they are to be used in the concrete shall be furnished to the contracting officer at least 40 days in advance of the time when the placing of the concrete is expected to begin. The contractor shall obtain fine and coarse aggregates for concrete from approved sources.

7-12. Proportioning. - a. Basis. - All concrete materials will be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

b. Control. - The exact proportions of all materials entering into the concrete shall be as directed by the contracting officer. The contractor shall provide all equipment necessary to positively determine and control the actual amounts of all materials entering into the concrete. The proportions will be changed whenever, in the opinion of the contracting officer, such change becomes necessary to obtain the specified strength and the desired density, uniformity and workability, and the contractor will not be compensated because of such changes.

c. Measurement. - All materials shall be measured by weight except that water may be measured by volume when so authorized by the contracting officer. One bag of cement will be considered as 94 pounds in weight and 1 gallon of water as 8.33 pounds.

d. Cement content. - Each cubic yard of concrete shall contain not less than the quantity of cement stated below:

Class "A" - 5.0 bags or 470 pounds
Class "B" - 4.0 bags or 376 pounds

For concrete deposited in water, the minimum cement content shall be 6.5 bags or 611 pounds to each cubic yard of concrete in place.

e. Water content. - (1) In calculating the total water content in any mix the amount of moisture carried on the surface of the aggregate particles shall be included. The total water content for a bag of cement for each batch of concrete shall not exceed the following:

Class "A" - 5.5 gallons or 45.8 pounds
Class "B" - 6.5 gallons or 54.1 pounds

In all cases, however, the amount of water to be used shall be the minimum amount necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity and workability. In general, the consistency of any mix shall be that required for the specific placing conditions and methods of placement, and ordinarily the slump shall be between 1 inch and 3 inches when tested in accordance with the current specifications for "Method of Test for Consistency of Portland Cement Concrete," of the American Society for Testing Materials.

(2) An increase in the maximum water content, based only on the requirements of materials added in accordance with Paragraph 7-06 c (2) to improve workability, will not be permitted unless comparative tests under job conditions show conclusively that such increase in water content will not result in a decrease in concrete strength and provided further that such increase does not exceed 1 gallon per cubic yard.

f. Aggregate content. - The total volume of aggregate to be used in each cubic yard of concrete shall be that necessary to produce a dense mixture of the required workability as determined by the contracting officer.

7-13. Mixing and placing. - a. Equipment. - The contractor shall provide at the site of the work a modern and dependable batch type mixing plant with a minimum capacity of 100 cubic yards of concrete per 8 hours, or if approved by the contracting officer, the contractor may use ready-mixed concrete delivered in standard truckmixing equipment of approved capacity. The equipment shall provide adequate facilities for the accurate measurement and control of all materials and for readily changing the proportion of materials to conform to the varying conditions of the work in order to produce concrete of the required uniform strength and durability.

b. Time. - The minimum time for mixing each batch, after all materials are in the mixer, shall be as follows:

1/2 to 1-1/2 cu. yd. mixer	1-1/2 minutes
Larger than 1-1/2 cu. yd. mixer	2 minutes

The mixer shall revolve a minimum of 12 revolutions after all materials have been placed in it, and at a uniform speed. Neither speed nor volume capacity of the mixer shall exceed those recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted.

c. Conveying. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Conveying of concrete by means of chutes will not be permitted except for short chutes in the forms to distribute the concrete. Chutes used shall be such that the concrete slides in them and does not flow. Chutes with a flatter slope than 1 on 2 will not be permitted. There shall be no free vertical drop greater than 5 feet except where specifically authorized by the contracting officer.

d. Placing. - (1) Concrete shall be placed before initial set has occured, and in no event after it has contained its water content for more than 45 minutes.

(2) Unless otherwise specified, all concrete shall be placed in the dry upon clean, damp surfaces, free from ice, frost or running water, and never upon soft mud, dry porous earth, or upon fills that have not been subjected to approved rolling, puddling or tamping so that ultimate settlement has occurred.

(3) All monoliths shall be of the dimensions shown on the drawings.

(4) All concrete shall be deposited in approximately horizontal layers not to exceed 24 inches in thickness, unless otherwise specifically authorized or directed by the contracting officer, and the concreting shall be carried on as a continuous operation, as far as

practicable, until the placing in the course, section, panel or monolith is completed. Unless otherwise shown on the drawings, courses shall generally have a minimum thickness of 4 feet, and a maximum of 18 feet, except that in hot weather the contracting officer may direct the maximum be reduced to 8 feet. A minimum time interval of 48 hours shall be allowed between successive courses for the dissipation of heat of hydration. In walls of buildings, courses including door or window openings shall terminate at the tops of the openings.

(5) In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On flat surfaces, where the congestion of steel near the forms makes placing difficult, a mortar of the same cement-sand ratio as is used in the concrete shall be first deposited to cover the forms.

(6) All top surfaces not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade and struck off by board screed (see Paragraph 7-15), except that top surfaces of walls and piers not covered by forms and which are not to be covered by additional concrete or backfill, when poured in excess of 10 feet in height in one pour, shall be carried not less than 2 inches above the specified finished elevation and struck off by board screed.

e. Vibrating. - Concrete shall be placed with the aid of mechanical vibrating equipment as approved by the contracting officer. Vibration shall be transmitted directly to the concrete unless otherwise directed by the contracting officer. The frequency of vibration shall be not less than 5000 per minute. The intensity of vibration shall be sufficient to cause flow or settlement of the concrete into place. The vibration shall be of sufficient duration to accomplish thorough compaction as approved by the contracting officer. External vibration may be used for thin sections where internal vibration will be impracticable. Vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces in order to secure smooth, dense, even surfaces. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures.

f. Construction joints. - Vertical joints shall be formed with tongue-and-groove bonds or keys at such locations and of such shapes and dimensions as approved or directed by the contracting officer. Horizontal joints shall be formed with roughened level joints or with keys, or, where horizontal pressure is always in one direction, with steps as approved or directed by the contracting officer. Where required, dowel rods shall be used. All concrete in vertical members shall have been in place not less than 12 hours, and longer if so directed by the contracting officer, before concrete in horizontal members resting thereon is placed. As soon as practicable after placing and immediately before placing the succeeding layers is resumed, all approximately horizontal surfaces shall be washed with a high pressure air-and-water jet, or cleaned as otherwise directed by the contracting officer. Sand shall be added to the air-and-water jet when required to remove alkali, algae, stains, and other substances injurious to the bond. The time and method of using the jet shall be such that all laitance, scum, etc. will be removed so the partly embedded

aggregate is not disturbed and is washed clean. After final cleaning and immediately before placing is resumed, the surfaces shall be wetted and spread with a layer of mortar 1/2 inch thick, thoroughly brushed in. The mortar shall be the same cement-sand ratio as the concrete. Where specified or otherwise required by the contracting officer for watertight construction, rubber water stops 6 inches in width, or otherwise as directed, shall be placed in the concrete to span the joint.

g. Cold weather. - Concrete shall not be placed when the ambient atmospheric temperature is below 35 degrees F., nor when the concrete is likely to be subject to freezing temperatures before final set has occurred, unless specifically authorized by the contracting officer in writing. When so authorized, the materials shall be heated in order that the temperature of the concrete, when deposited, shall be not less than 50 degrees F. nor more than 70 degrees F. All methods and equipment for heating shall be subject to the approval of the contracting officer.

h. Hot weather. - For concrete placed during the extremely warm summer months and otherwise when directed by the contracting officer, the aggregates shall be cooled by frequent spraying in such manner as to utilize the cooling effect of evaporation. During such periods the placement schedule shall be arranged as approved by the contracting officer in such manner as to provide time for the temperature of the previously placed course to begin to recede. The mixing water shall be the coolest available at the site in so far as is practicable.

7-14. Test specimens. - a. Number. - Test specimens, to determine whether the compressive strength of the concrete is in accordance with that specified in Paragraph 7-03, will be taken by the inspector. At least 1 set of 3 specimens will be made for every major pour and in general for every 250 cubic yards of concrete placed, but in any event a sufficient number of specimens will be taken to give a comprehensive knowledge of the concrete placed during each day in each section of the work.

b. Method. - All specimens will be taken from the concrete at the mixing plant. The specimens will be tested by the Government at the Central Concrete Laboratory, West Point, N. Y. All costs of transportation and testing of specimens will be borne by the Government.

7-15. Finishing. - a. Immediately after placement, the concrete shall be properly forked back along the face of all forms by the use of standard concrete forks or spades unless otherwise specifically authorized or directed by the contracting officer. The finished surfaces shall be free from sand streaks or other voids and the plastering over of such surfaces will not be permitted. Defective concrete shall be repaired by cutting out the unsatisfactory material, and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely to the other work. This concrete shall be drier than the usual mixture and shall be thoroughly tamped into place. All surfaces of concrete not covered by forms, that are not to be covered by additional concrete, or backfill, shall have a wood float finish without addition of mortar, and

shall be true to elevations as shown on the drawings. Care shall be taken to see that all excess water is removed before making this finish. Other surfaces shall be brought to the specified finished elevation and left true and regular as approved by the contracting officer. Where considered necessary by the contracting officer, or where indicated on the drawings, joints shall be carefully made with a jointing tool. Every precaution shall be taken by the contractor to protect finished surfaces from stains or abrasions. No fire shall be permitted in direct contact with any concrete at any time. Concrete surfaces or edges likely to be injured during the construction period shall be properly protected by leaving the forms in place, or by erecting covers satisfactory to the contracting officer.

b. Floor surfaces. - Unless otherwise specified, floors of all buildings, and other surfaces where indicated on the drawings or required by the contracting officer, shall be finished with a 1-inch monolithic sand-cement mortar surface. All water, laitance and any foreign matter shall be removed from surfaces. The topping mixture shall be spread evenly over all the base within 45 minutes after the base has been placed. The mortar shall be of 1 part cement and 2 parts approved clean sand. The cement and sand shall be thoroughly mixed dry and then sufficient water shall be added to produce a medium stiff mortar. After placing, the mortar shall be floated to a true, regular surface with a wood float and steel-troweled to a smooth finish. Troweling shall be the minimum ammunt consistent with obtaining a smooth dense surface and shall not be done until the mortar has hardened sufficiently to prevent excess fine material from being worked to the surface.

c. Special finishing. - As soon as possible, after removal of forms and before concrete has become too hard, ceiling areas and roof beams shall be thoroughly wetted and rubbed with fairly coarse corundum stone until paste is formed on the surface. The rubbing shall continue until all deformities have been removed and a smooth, even surface exists, but in no event shall the coarse aggregate of the concrete be exposed. A fine corundum stone shall be used in obtaining the final finish, producing a fine paste which shall be allowed to take a "reset," leaving the entire ceiling and roof beams uniform in texture and color. After the surface has hardened and has been accepted by the contracting officer, it shall be cleaned and dusted with canvas and shall be free from all unsound patches, paste, lather, powder and objectionable marks.

7-16. Curing. - a. Warm weather. - All concrete shall be adequately protected from injurious action by the sun. Fresh concrete shall be protected from heavy rains, flowing water, and mechanical injury. All concrete shall be kept wet for a period of not less than 14 days by covering with water, or with an approved water-saturated covering, or by a system of perforated pipes or mechanical sprinklers, or any other approved method which will keep all surfaces continuously (not periodically) wet. Where wood forms are left in place for curing, they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and entirely free from any elements which in the opinion of the contracting officer might cause staining or discoloration of the concrete.

b. Cold weather. - Concrete when placed during cold weather shall be kept moist and provided with adequate protection for a period of not less than 14 days, subject to the approval of the contracting officer, so that the air in contact with the concrete will be maintained at temperatures between 50 degrees F. and 70 degrees F. for at least the first 5 days of the curing period. For massive sections, where the atmospheric temperatures are sufficiently low in the opinion of the contracting officer to cause excessively rapid cooling and contracting of the exterior surfaces, this period for maintaining the temperature of the air in contact with the concrete between 50 and 70 degrees F. shall extend over the entire curing period. Salt or other chemicals shall not be admitted into the mixture to prevent freezing.

FORMS, REINFORCEMENT AND PAYMENT

7-17. Forms. - a. Materials. - Forms shall be of wood, steel or other approved material, except that where lining is not specified, the sheeting for all exposed surfaces shall be tongue-and-groove lumber of uniform width unless otherwise specifically authorized. Forms of like character shall be used for similarly exposed surfaces in order to produce a uniform appearance. The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the approval of the contracting officer.

b. Construction. - Forms shall be built true to line and grade, and shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports. Responsibility for their adequacy shall rest with the contractor. Their surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will be not less than 2 inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. Unless otherwise indicated, suitable moldings shall be placed to bevel or round exposed edges, at expansion joints or any other points as may be required by the contracting officer.

c. Coating. - Prior to the placing of steel reinforcement or concrete, forms for exposed surfaces shall be coated with a non-staining mineral oil. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

d. Removal. - Forms shall not be removed without the approval of the contracting officer, and all removal shall be accomplished in such manner as will prevent injury to the concrete. Forms shall not be removed before the expiration of the minimum number of days indicated below, except when specifically authorized by the contracting officer. When, in the opinion of the contracting officer, conditions on the work are such as to justify it, forms may be required to remain in place for longer periods.

Arches, beams and slabs	7 days
Columns	7 days
Walls and vertical faces	2 days

e. Form lining for buildings. - In addition to the requirements for work specified above, the forms for walls and ceilings of buildings which will be visible in the finished structures shall be lined with plywood or with pressed wood sheets, "Masonite" or approved equal. Lining shall be applied directly to the sheeting. Forms for windows and door jambs, and their flat or arched soffits, shall be lined also and the corner intersections chamfered. Jointing of the lining shall be neat and close and no patch places, cleats or blocking will be permitted. Overrun of lining shall be trimmed to secure proper fit to adjoining surfaces. Lining with bruises, imprints or hammer marks shall not be used.

7-18. Furnishing, bending, and placing steel reinforcement (Item 15). - a. Work included. - (1) The contractor shall furnish, cut, bend and build into the concrete, in accordance with the drawings prepared by him and approved by the contracting officer (see subparagraph (2) below), all steel reinforcement of deformed bars, dowels or anchors, or any other plain steel for similar purposes. Materials shall be as specified in Paragraph 10-02 a(1).

(2) Steel reinforcement may be cut and bent at the mill or in the field. All bending shall be in accordance with standard approved practice and by approved machine methods. The contractor shall furnish drawings showing bending details and placing schedules of steel reinforcement for approval by the contracting officer. The drawings furnished by the contractor shall be in accordance with the provisions of Paragraph 1-04 c.

b. Placing. (1) All steel reinforcement shall be placed in the exact position and with the spacing shown on the drawings or ordered, and it shall be so fastened in position as to prevent its becoming displaced during the placing of the concrete. The clear distance between parallel rods shall be not less than one and one-half times the diameter of round rods, or twice the side dimensions of square rods, and unless specifically authorized, shall in no case be less than 1 inch.

(2) Except where otherwise indicated, steel reinforcement shall be placed as follows:

(a) All main reinforcement shall be placed not less than 3 inches from any surface, except in slabs and in buildings.

(b) All main reinforcement in walls and slabs exposed to the weather and in fire-resistant construction shall be placed not less than 1-1/2 inches from the surface in walls and slabs, 2 inches in floor beams and 2 inches in girders and columns. The covering of stirrups, spacer rods, and similar secondary reinforcement may be reduced by the diameter of such rods. The above dimensions shall be measured from the face of the reinforcement to the face of the forms.

(c) Where splices in reinforcement, in addition to those indicated, are necessary, there shall be sufficient lap to transfer the stress by bond as may be directed. Rods shall be lapped not less than 40 diameters and splices shall be staggered. The lapped ends of rods shall be separated sufficiently or connected properly to develop the full strength of rod.

c. Protection. - Steel reinforcement shall be new unrusted stock, free from loose scale. It shall be at all times satisfactorily protected from moisture until placed in final position. Ends of rods that are to be left projecting for a considerable time shall be protected from corrosion by heavy wrappings of burlap saturated with bituminous material.

7-19. Embedded items. - In addition to steel reinforcement, there shall be built into, or set, or attached to the concrete, steel beams, pipes, manhole frames and covers and other metal objects as shown on the drawings or ordered, including brass reference plugs which will be furnished by the Government (see Paragraph 1-13). All necessary precautions shall be taken to prevent those objects from being displaced, broken or deformed. Before placing concrete, care shall be taken to determine that any embedded or wood parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. The embedding of wood in concrete shall be avoided whenever possible, metal being used instead. The concrete shall be packed tightly around pipes and other metal work so as to prevent leakage and secure perfect adhesion. Drains shall be adequately protected from intrusion of concrete into them. Payment for this work is included in the several items for drains and metal work.

7-20. Expansion and contraction joints. - a. Expansion and contraction joints shall be constructed at such points and of such dimensions as may be indicated or required. The method and materials used shall be subject to the approval of the contracting officer and the materials shall conform to current Federal Specifications wherever applicable. Unless otherwise indicated on the drawings, or required by the contracting officer, expansion joints shall be made by coating concrete surfaces with a coat of bituminous cement as specified in subparagraph b below, and then applying premoulded sponge rubber or compressed cork filler of the thickness shown on the drawings which shall then be similarly coated. The rubber or cork filler shall be placed where shown on the drawings. In no case shall corner protection angles or other fixed metal, embedded in the surface of the concrete and bonded, be continuous through an expansion joint. Rubber water stops shall be of high grade natural rubber having a tensile strength no less than 3800 pounds per square inch, with an elastic deformation of 650 percent and shall comply with the applicable provisions of Federal Specification ZZ-R-601a Rubber Goods; General Specifications (Methods of Physical Tests and Chemical Analyses). All splices in rubber water stops shall be shop-vulcanized. Payment for all expansion joint material shall be included in the contract unit price for concrete, including rubber water stops required as shown on the drawings.

b. Bituminous cement shall be an internal set-up cement of asphaltic base, composed of a liquid asphaltic fluxing agent with an admixture of powdered asphalt, asbestos fiber and other suitable inorganic fillers. When mixed in the proper proportions, the cement shall be suitable for proper trowel application and shall harden to a consistency as specified in subparagraph (3) below.

(1) The material shall be supplied in containers of proper relative size to apportion batches with the desired troweling consistency. The liquid asphaltic fluxing agent shall be a smooth uniform mixture, not thickened or jelled, and showing no separation which cannot be easily overcome by stirring. The powdered cement shall be a uniform mix containing no matted lumps of fiber.

(2) When mixed in the proportions recommended by the manufacturer, the cement shall yield not less than 85% of non-volatile matter when 10 grams are heated in an oven at 105to 110 degrees Centigrade for 24 hours.

(3) When tested in accordance with A.S.T.M. Specification D5-25 for "Penetration of Bituminous Materials" the above mixture shall have the following characteristics: Immediately after mixing, using a 5/8 inch diameter steel ball, 114 grams, 5 seconds, the mixture shall permit a penetration greater than 300. The same specimen, after a lapse of 24 hours at 25 degrees Centigrade under water, shall permit a needle penetration 100 grams, 5 seconds, of not more than 100. The same specimen, after a lapse of 30 days at 25 degrees Centigrade under water, shall permit a needle penetration 100 grams, 5 seconds, of not more than 50.

7-21. Measurement and payment. - a. Portland cement. (Item 12).- (1) The quantity to be paid for under Item 12 will be the number of barrels of cement used in all parts of the work unless specifically excepted. For purposes of payment, a barrel of cement shall be considered 376 pounds net of cement. The contract unit price for the cement shall include payment for all expenses incidental to delivering the cement upon the work in which it is to be used.

(2) Only the cement furnished for concrete work to be done under Items 13 and 14 (see Paragraph 1-05) will be paid for at the contract unit price for Item 12, "Cement." Cement used for mortar and grout in pipe joints, brick and stone masonry, and under other items will be included in the payment for those items.

b. Concrete (Items 13 and 14). - See Section VIII.

c. Steel reinforcement (Item 15). - (1) The quantity to be paid for under Item 15 will be the number of pounds of steel placed in accordance with the drawings or as directed by the contracting officer, measured as specified. It will not include any waste material due to the fact that the lengths supplied are too long for their purpose. The quantity to be paid for will, however, include extra metal in laps, where authorized, due to the fact that single bars would be unreasonably long. In computing the weights, the theoretical weight of plain bars will be used as tabulated in Federal Specification QQ-B-71a for the lengths placed as required. Wire or metal clips and other supports necessary to hold the steel in place will not be considered as reinforcement but shall be furnished by the contractor without additional compensation. The contract unit price for Item 15, "Steel Reinforcement," shall include furnishing, bending, cutting, placing, fastening in position, coating and protecting the reinforcement, and all other work and materials connected therewith. (See Paragraph 7-18 a.)

(2) Partial payments up to 50 percent of the contract price will be made for all steel reinforcement delivered to the site of the work provided the quality of such material is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the material delivered to the site of the work. The material shall be stored and kept protected from deterioration, in a manner satisfactory to the contracting officer. If any steel reinforcement stored and partly paid for is not kept protected, no further partial payments will be made and the material will be protected by the contracting officer at the expense of the contractor.

7-22. Cinder concrete. - a. Where concrete is indicated as filler in the roof of the pumping station, it shall be mixed in the approximate proportion of 1 bag of cement to 2 cubic feet of sand and 4 cubic feet of cinders, mixed as required by the contracting officer. Test blocks of concrete shall be made by and at the expense of the contractor before the concrete is placed, to determine the correct proportions of the ingredients to obtain a cinder concrete of proper qualities for nailing and permanently supporting the roof surfacing. The cement and sand shall conform to the requirements for regular concrete herein. The cinders shall be coarse, clean, and free from dust. The top surface of the concrete shall be given a smooth and even finish, and shall have a uniform slope to the gutters.

b. If so elected by the contractor and approved by the contracting officer, a substitute for cinders may be used. Any such substitite must be a commercial product of proven quality, prepared especially as a roof filler. When mixed and used as recommended by the manufacturer, the resulting product must have strength and nailing properties equivalent to that of cinder concrete and its unit weight shall not be in excess of that of cinder concrete of equivalent quality.

c. Payment for cinder concrete including cement will be included in the payment for Item 16, "Pumping Station Superstructure" (see Paragraph 9-17).

SECTION VIII. CONCRETE STRUCTURES (Items 13 and 14).

8-01. General. - a. Description. - Concrete structures shall be constructed as shown on the drawings or in accordance with modifications designated by the contracting officer. Concrete shall conform to all the requirements of Section VII for concrete of the class specified. Surfaces of concrete shall be finished as specified in Paragraph 7-15, except as otherwise specified in this section or indicated on the drawings. In all concrete walls, vertical construction joints shall be provided for and spaced not to exceed 30 feet apart.

b. Measurement and payment. - The quantity to be paid for under Items 13 and 14 will be the number of cubic yards of concrete satisfactorily placed within the required limits. No deductions shall be made for openings having a cross-sectional area less than that of a 12-inch pipe, nor for the space occupied by reinforcing steel, miscellaneous metal, wood nailing strips, or by other materials required to be built into the concrete. The contract unit prices shall include payment for all costs of furnishing materials, erecting and removing forms, mixing and placing concrete and furnishing and installing expansion joint material, except that cement, reinforcing steel and other metal work are included under other items. (See Paragraph 7-21.)

8-02. Concrete - Class "A" (Item 13). - a. Description. - This classification includes the Class "A" concrete for the pumping station and miscellaneous structures, placed between the limiting lines and grades as shown on the drawings or directed by the contracting officer. Forms for surfaces exposed to view shall be constructed in accordance with the provisions of Paragraph 7-17. Concrete fins formed on exposed surfaces shall be removed after the forms are stripped. Pipe drains and miscellaneous metal work shall be installed as provided for on the drawings. Any grouting of metal work shall be included as part of the concrete.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. Payment will be made at the contract unit price for Item 13, "Concrete - Class 'A'."

8-03. Concrete - Class "B" (Item 14). - a. Description. - This classification includes the Class "B" concrete for the pumping station foundation as shown on the drawings or directed by the contracting officer. Piping and miscellaneous metal work shall be set and concreted in place as provided for on the drawings.

b. Measurement and payment. - The volume of concrete to be paid for will be the volume computed between the limiting lines and grades, as shown on the drawings or directed by the contracting officer. Payment will be made at the contract unit price for Item 14, "Concrete - Class 'B'."

SECTION IX. PUMPING STATION SUPERSTRUCTURE (Item 16)

9-01. Work included. - a. The contractor shall furnish all labor, equipment and materials, except the plaque furnished by the Government (see Paragraph 9-15 b), and shall construct and complete, in accordance with the specifications and the drawings, the pumping station superstructure. Item 16 shall include all work incidental to the construction of the pumping station and other miscellaneous work in the pumping station as shown on the drawings, except the furnishing and installation of such equipment as is specifically included in other items of the contract and the concrete work and reinforcing steel which will be paid for under Items 13 and 15. The work includes the concrete and reinforcing steel in the roof slab, the structural steel, consisting essentially of columns, roof beams, crane beams and rails, brick, glass-block and cast stone masonry, doors, door frames, louvers, builders' hardware, roofing, cast iron roof insulating sleeves, copper downspouts and cast iron boots, painting and other work included in the construction of the pumping station superstructure.

b. In accordance with the provisions of Paragraph 1-04 c, the contractor at his option may submit for approval an alternate welded design of the structural steel frame.

9-02. Structural steel. - a. All structural steel shapes, plates, bars, and their products shall conform to the requirements of Federal Specification QQ-S-711a for Steel; Structural (for) Bridges. The fabrication and erection of all structural steel shall conform to the requirements of the current American Institute of Steel Construction Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

b. Drawings for approval. - Before commencing fabrication, the contractor shall submit to the contracting officer for approval complete shop details in accordance with Paragraph 1-04 c.

9-03. Brick masonry. - a. Brick. - All brick shall be whole, sound, straight, hard, uniform in structure, with true, even faces and sharp edges, and shall be uniform in size for their respective kinds. The facing of all exterior walls shall be standard size red shale brick in a full range of color to include reds, browns, hearts, bronzes and blue-blacks. These brick shall be "A" grade, shall have a matte texture, and shall be similar and equal to brick as manufactured by the following companies: Claycraft Company, Columbus, Ohio, Hydraulic Pressed Brick Company, Washington, D. C., or Belden Brick Company, Canton, Ohio. The interior of the building and brick for backing up shall be best quality "Hard" grade sand-lime brick, approximate size 2-1/4 by 3-3/4 by 8 inches, conforming to the requirements of Federal Specification SS-B-681. The contractor shall submit to the contracting officer for approval samples of all brick he proposes to use.

b. Mortar. - Mortar shall be composed of one part Portland cement, one-half part lime putty, and three parts sand by volume. Mortar shall be thoroughly mixed either by hand or in a mechanical batch mixer, and only in such quantities that it can be used completely before it has attained its initial set. The use of a continuous mixer or of retempered mortar will not be permitted. Only enough water shall be used to make a workable mix. All sand shall conform to the requirements of Paragraph 7-06 for fine aggregate and shall pass a No. 8 standard sieve. Sand used for the mortar for face brick shall be a natural white or clear sand approved by the contracting officer. Lime shall conform to Federal Specification SS-L-351 for Type "M" Hydrated lime. Cement shall be Portland cement conforming to the requirements of Paragraph 7-05.

c. Laying brick. - (1) All brick masonry shall be accurately laid in courses as indicated on the drawings. All exposed surfaces shall be laid to lines that are plumb, true, straight, and level. Each brick shall be laid in a full bed of mortar and shall be shoved into place in the mortar, making joints that are full without subsequent slushing or filling. Except where otherwise indicated on the drawings, the brick course including mortar joint shall be 2-5/8 inches high. Vertical and horizontal mortar joints shall have the same thickness. The mortar joints of exposed face and sand-lime brickwork shall be neatly underhand struck. Except where otherwise indicated, all exposed faces of brickwork shall be laid in common bond, with stretchers bonded every sixth course by a course of headers staggered for exterior and interior faces. Metal wall ties shall not be used for the bonding of brickwork, except where indicated on the drawings or authorized by the contracting officer. Care shall be taken to insure the weather-tightness of the brick masonry to its concrete foundation. The saturated fabric flashing shown on the drawings at the foundation of the brick walls shall be similar and equal to the through-wall flashings manufactured by Sandell Mfg. Corp., 70 Phillips St., Watertown, Mass., or to the Wasco copper-fabric flashing, manufactured by Wasco Flashing Co., Cambridge, Mass.

(2) The courses shall be laid to correspond exactly in height with the heads of doors and other openings without any cutting or chipping of the brick. Door frames and all other fixtures shall be built into the brickwork as it is laid. Brick masonry around glass block panels and door openings shall have jambs built true and plumb with the reveals at right angles and of the depth shown on the drawings; and the brickwork shall either be kept back a sufficient distance or raked out to permit a caulked joint as indicated on the drawings. The filling in or backing brickwork shall be kept level with the facing and each piece of facing material shall be backed up solid with brick and mortar so as to make a perfectly bonded homogeneous mass between wall lines. All walls shall be carried up together as nearly as possible on the same level. If during construction, the walls become displaced, damaged, or marred by the contractor or his workmen, the contractor shall without additional compensation, execute all patching and repairing necessary to leave the entire work in perfect condition. The placing of put-logs in masonry walls is prohibited. The contractor shall place boards over all sills and projecting stone or water tables during construction.

(3) Care must be taken that the tops of all unfinished work are thoroughly covered or protected against inclement weather, by means of waterproof canvas and boards. Brick laid in warm weather shall be kept wet before laying and shall be wet when laid. Bricks laid in cold weather shall be laid dry and warm. In winter the brick, sand, water, and other material shall be kept warm and, if required by the contracting officer, shall be heated by steam pipes or other approved methods in order that the work shall proceed properly. The brickwork shall be carefully covered and protected to prevent freezing.

(4) The contractor shall carefully set or build in all door frames, wall plates, anchors, beams, bolts, or other iron work; bronze, or other incidental materials; and shall build all recesses and pipe chases, as indicated on the drawings, or directed by the contracting officer.

(5) After completion, all brickwork shall be cleaned and pointed where necessary. Before pointing, the joints shall be raked out, cleaned and well moistened. The caulking around all doors, louvers and ventilators shall be carefully checked, and the joints recaulked where necessary.

(6) The dimensions of the brickwork shown on the drawings may be varied slightly depending on the size of the brick used.

9-04. Glass block. - a. Glass block panels shall be installed as shown on the drawings. The blocks shall have a light transmission of not less than 70 percent of the incident light. The glass block shall be hollow, partially evacuated, water-clear units of pressed glass construction of the best quality, similar and equal to the units manufactured by the Owens-Illinois Glass Company, Toledo, Ohio, or the Pittsburgh Plate Glass Company, Pittsburgh, Pa. Unless otherwise shown on the drawings, all glass block shall have a standard size of 11-3/4 by 11-3/4 by 3-7/8 inches. A sample of the type of glass block the contractor proposes to furnish shall be submitted for the approval of the contracting officer, with drawings showing the details of installation in accordance with the standard practice of the manufacturer of the glass block (see Paragraph 1-04 c).

b. Laying of block. - (1) Each block shall be set in a 1/4-inch layer of mortar composed of one part Portland cement, one part lime, and four parts sand by dry volume. The sand used in the mortar shall conform in quality to that specified in Paragraph 9-03 b for sand used for mortar for face brick. Glass blocks shall be laid true to line and grade. Both head and bed joints shall be filled completely with mortar; after the mortar has reached its initial set, the joints on both surfaces shall be compressed and pointed with a metal pointing tool, leaving the finished surface of the joint smooth and non-porous. Blocks shall not be cleaned until after mortar has reached its final set.

(2) Horizontal mortar joints shall be reinforced with continuous 20-gage expanded metal wall ties 2-3/8 inches wide or with wire wall ties of approved type and of a length suitable for the glass block panel, galvanized after forming. Ties shall run continuously by lapping 6 inches at ends; they shall be placed every course and shall not extend into brick masonry or pierce expansion joints.

(3) Expansion joints shall be provided at the head and jambs of all glass block panels, and all joints at head and jamb of panels shall be kept free from mortar and free from transmission of structural loads carried by adjacent masonry. Expansion joints shall consist of a premoulded waterproof expansion joint filler furnished and installed in accordance with the detailed drawings furnished by the contractor and approved by the contracting officer. After the glass block panels have been laid and the mortar has set, non-staining oakum shall be caulked between the sides of the block and the sides of the "chase" to within 1/2 inch from the finished surface. The 1/2-inch recess shall be filled flush with the finished surface with non-hardening waterproof caulking material similar and equal to "Vulcatex" manufactured by A. C. Horn Co., Long Island City, N. Y., "Kaukit" manufactured by L.Sonneborn Sons, Inc., New York, N. Y., or other approved elastic (or mastic) compound as shown on the drawings.

9-05. Chimney. - The chimney shall be constructed as shown on the drawings, and shall be lined with size 8-1/2 by 13 inch fire clay flue lining. The joints shall be well cemented and struck smooth inside. A suitable cast iron cleanout door and thimble of the size indicated on the drawings shall be installed in the chimney.

9-06. Stonework. - a. All stonework shall be of cast stone, light-gray, and shall be placed as indicated on the drawings. The stone shall be uniform in color, sound, and perfect throughout; and subject to inspection before being placed in the work. All exposed surfaces shall have a rubbed finish. The cast stone shall be similar and equal to that made by the Emerson and Norris Company, Boston, Mass., and conform in all respects to Federal Specification SS-S-721, for architectural cast stone, Type 1. The contractor shall submit samples of the precast stone proposed to be used, for the approval of the contracting officer. Samples shall be not less than 8 by 12 inches. The contractor shall also submit evidence satisfactory to the contracting officer that the manufacturer who will furnish the cast stone has had at least 10 years' experience in designing and manufacturing cast stone of satisfactory appearance and durability.

b. Before purchasing the stone, the contractor shall submit, for approval of the contracting officer, prints (in quadruplicate) of drawings showing in detail the sizes, coursing, and full details of trim. (See Paragraph 1-04 c.)

c. The casting, sizing, and coursing of all cast stone shall be done in accordance with the approved detail drawings. The stone shall be dressed and finished to a clean, smooth, uniform surface. Washes shall

be cast or cut on the tops of copings, and drips on the undersides of projections where indicated on the drawings. All arrises shall be sharp and true. Anchors, cuts for accommodating steel work, and other incidental details shall be provided as required. Holes and sinkages shall be cast or cut in stones for all anchors, clamps, dowels, etc. Lewis holes shall be cut or cast in stones weighing more than 100 pounds. Lewis holes or other holes shall be not closer than two inches to exposed faces of stone, and holes on exposed faces of stone are prohibited. The cast stone shall be made to check in dimensions with all adjoining brickwork.

d. Ornamental panel work shall be cast monolithically. The contractor will be furnished with small size models by the contracting officer. Full size models shall be made by the contractor and approved by the contracting officer before use. Suitable anchors shall be cast in place in each block of ornamental cast stone. All modelled work shall be cut true to detail by experienced stone carvers.

e. Mortar for setting the cast stone shall consist of one part Portland cement, three parts fine white sand, and 10 percent by volume of hydrated lime.

f. Setting stone. - (1) Just before setting, each stone shall be brushed clean and thoroughly drenched with clean water. The stone shall then be accurately set, by competent stone setters, true to line and level, with full flushed joints. Each stone shall rest on a full bed of mortar placed under the center of the stone; the amount of mortar being sufficient to fill all anchor holes and to fill out to the edges of the stone on all sides. All stone shall be set with 1/4-inch joints, raked out at the face to a depth of one inch and left for future pointing. The backs of stone facings shall be pargeted with neat cement where shown on the drawings. Where required in connection with the setting of heavy stones and projecting courses, in order to arrest the squeezing out of mortar beds, tipping or uneven setting of the stone; and wherever required in connection with stone bedded on structural members, to prevent cracking or spalling from unequal pressure, the contractor shall provide and install lead pads or buttons. These pads or buttons shall be made of soft, sheet lead, either round or octagonal in shape, and of the same thickness as mortar joints. They shall be set not less than one inch back from the face of the stone, and have the mortar bed spread around them. Wherever practicable, heavy stones shall be set with derricks and lifted with lewis plugs or hoisting loops. Where lewis plugs or hoisting ropes cannot be used, the stone shall be set with clamps. The use of pinch bars, except on the embedded parts of the stones, is prohibited. No defective stones and no broken, spalled, patched, or otherwise damaged stone shall be set in place. Rejected material shall be removed promptly from the work area.

(2) The contractor shall furnish and install all necessary anchors and dowels, as indicated on the drawings or as required by the contracting officer. Dowels other than bronze shall be coated with an approved damp-proofing paint before being used.

(3) The contractor shall protect all cast stone work from damage of every description until all construction work is completed. Any damaged work shall be replaced at the contractor's expense.

(4) After the stone has been set, all work shall be gone over by a competent stone mason, thoroughly cleaned, and all joints brushed clean, soaked with clean water, filled solid with pointing mortar, and dressed. The use of wire brushes, or acids and solutions which might cause discoloration, will not be permitted in cleaning stone.

(5) The mortar for pointing stone work shall consist of one part white "Medusa" cement or equal, two parts white sand, and 10 percent by volume of hydrated lime. The mortar shall be colored as directed by the contracting officer.

9-07. Doors. - a. Doors shall be of the type and design shown on the drawings. The contractor shall submit to the contracting officer, in accordance with the provisions of Paragraph 1-04 c, shop drawings showing the details of all doors.

b. The entrance door shall be of the vertical, double-leaf, ornamental type, supported at the jambs with butts as shown on the drawings. The quality of the material and workmanship shall in all respects be equal to the flush hollow metal door manufactured by the Richmond Fireproof Door Co., Richmond, Indiana. Bronze weather stripping as indicated on the drawings shall be equal to the product of the Chamberlin Metal Weather Strip Company.

c. The service door shall be of the vertical swinging, steel industrial type, supported at the jambs with 3 butts. The quality of the material material and workmanship shall in all respects be equal to the hollow metal door manufactured by the Richmond Fireproof Door Co., Richmond, Indiana.

d. The doors shall be painted and finished at the shop in the color to be selected by the contracting officer in accordance with the standard practice of the manufacturer of the doors. The doors shall be cleaned and primed with one coat of approved rust-resistant paint baked on, and one coat of mineral filler shall be baked on and rubbed before assembling. The doors shall be finished with two additional coats, baked on, the last coat being of the color selected. If the paint on the doors is marred in transit or during installation, the finish shall be replaced at the contractor's expense to the satisfaction of the contracting officer.

9-08. Door frames. - As shown on the drawings, the entrance door shall be provided with a suitable cast-bronze saddle, properly fitted and secured in place with expansion bolts. All door frames shall be made of steel, accurately fitted, welded, and anchored in place as shown on the drawings. Loose lintels, as indicated on the drawings, shall have not less than 6 inches of bearing at each end.

9-09. Builders' hardware. - a. The contractor shall furnish and install heavy bronze hardware for the entrance door, including locksets, butts, chain bolts, and checks, and all other details of a complete installation.

b. The hardware shall be secured in place with machine screws and reinforcing plates shall be provided where necessary. Grouting around the foot bolt keepers in the floor shall be brought flush with the top. The hardware shall be subject to approval of the contracting officer, shall be of the heavy, solid bronze type, and of sufficient strength and size for the use intended. It shall conform to Federal Specifications FF-H- series, where applicable, and shall be similar and equal to products of the Russell and Erwin Mfg. Co., New Britain, Conn., as shown on the drawings.

9-10. Roofing. - a. Deck. - The roof slab and beam covering shall conform to the requirements for Class "A" concrete as specified in Section VII. Before taking its initial set the concrete shall be struck off approximately to grade and then roughened with a broom. When directed by the contracting officer or in any event not less than 48 hours after the slab has been poured the contractor shall thoroughly clean the slab, dampen it and place a filler slab of cinder concrete to the lines and grades indicated on the drawings (see Paragraph 7-22). The cinder concrete slab shall be provided with expansion joints, one adjacent to the parapet and the other dividing the slab, at the locations shown on the drawings, which shall conform to the applicable provisions of Paragraph 7-20. This slab of concrete shall be struck off and wood float finished to a surface with a reasonably smooth finish. Forms and shores under the roof slab shall not be removed or disturbed in less than 14 days after placing of the cinder concrete and then only upon specific authorization of the contracting officer.

b. The cinder concrete filler slab shall be covered with a built-up gravel roof as follows: Before the application of any roofing materials, the concrete slab shall be smooth, clean, firm, and dry. The entire surface of the slab shall then be coated uniformly with an approved asphalt primer, using not less than one gallon of primer for each 100 square feet of roof surface. Not less than 24 hours after the application of the priming coat the entire surface shall be coated uniformly with hot asphalt conforming to the Tentative Specifications for Asphalt for Use in Constructing Built-Up Roof Coverings (A.S.T.M. Designation: D 312-39T) of the American Society for Testing Materials. Into this coating, while hot, there shall be laid four layers of 15-pound, 36-inch asphalt-saturated felt over the entire surface of the roof, lapping each sheet 27-1/2 inches over the preceding one, lapping the ends of the sheets not less than 6 inches, and mopping with asphalt the full 27-1/2 inches so that in no place shall felt touch felt. The felt shall conform to Federal Specification HH-F-191 for Asphalt-Saturated Felt. At all vertical surfaces the roofing shall be carried up at least 6 inches and thoroughly mopped to the wall so that contact is obtained throughout. The layers of felt shall be laid so as to be free from wrinkles and buckles. Over the entire surface there shall be poured from a dipper a uniform

coating of asphalt, into which, while hot, there shall be embedded not less than 400 pounds of gravel per 100 square feet. Not less than 160 pounds of asphalt shall be used for constructing each 100 square feet of the completed roof and the asphalt shall be applied at a temperature of approximately 350 deg. F. The roofing gravel shall be hard, durable, water worn, dry, and free from clay, loam, sand, or other foreign substances. All gravel shall pass a 3/4-inch square mesh sieve, not less than 80 percent shall pass a 3/8-inch square mesh sieve and shall be retained on a 1/4-inch square mesh sieve, and 100 percent shall be retained on a 1/8-inch square mesh sieve.

9-11. Flashings. - All copper flashings indicated on the drawings or otherwise required shall be 16-ounce copper conforming to Federal Specification QQ-C-501, Type V. The chimney shall be flashed and counterflashed. The concrete bases for the exhaust silencers shall be flashed as shown on the drawings.

9-12. Louvers and ventilators. - Where shown on the drawings louvers of the size indicated shall be placed. The frame of these louvers shall be of 32-ounce and the blades of 48-ounce cold-rolled copper mounted on bronze bearings. The louver frames shall be constructed in such a manner that will assure a water-tight connection between the frame and the wall. They shall be equipped on the exterior with copper mesh screens of the size and type made by the same manufacturer who furnishes the louvers. The adjustable louvers shall be similar and equal to those manufactured by the H. H. W. Bergmann & Co., New York, N. Y. The ventilator shall be of the Uno braced turbine, wind-driven type, of standard galvanized iron construction as manufactured by the Uno Ventilator Company, Cliftondale, Mass., or equal. The metal base supporting the ventilator shall incorporate drip gutters to carry off condensation. The contractor shall furnish detailed drawings for approval, showing method of anchoring the ventilator in place. (See Paragraph 1-04 c.)

9-13. Steel partition. - The partition and door enclosing the plumbing fixtures shall be similar and equal to the insulated flush partition, Type "FF" as manufactured by Jamestown Steel Partitions, Inc., Jamestown, N. Y., and shall be painted with a color selected by the contracting officer in accordance with the standard practice of the manufacturer of the steel partition. The contractor shall furnish detail drawings of the partition, for approval, in accordance with the standard practice of the manufacturer of the steel partition. The contractor shall furnish detail drawings of the partition, for approval, in accordance with the provisions of Paragraph 1-04 c.

9-14. Downspouts. - a. The contractor shall furnish and install, under Item 16, the copper downspouts with scupper box heads, bronze beehive strainers and cast iron boots, as located and shown on the drawings.

b. The contractor shall submit for approval detail drawing for the scupper box head he proposes to install in sufficient detail to check the design (see Paragraph 1-04 c).

9-15. Miscellaneous details. - a. The contractor shall furnish and install, under Item 16, the bronze letters over the entrance door as shown on the drawings and shall submit, for approval, template for setting the letters.

b. The contractor shall install under Item 16, at the location shown on the drawings, the plaque which will be furnished by the Government.

9-16. Painting. - The concrete floor of the pumping station, the concrete machinery bases and the side walls below the brick masonry shall be painted as specified in Paragraph 18-07. The cost of all painting shall be included in the contract price for Item 16 (see Paragraph 9-17).

9-17. Payment. - Payment for constructing and completing the pumping station superstructure in accordance with the specifications and the drawings will be made at the contract price for Item 16, "Pumping Station Superstructure."

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SECTION X. METALS AND EMBEDDED ITEMS (Items 17 to 20 incl.)

10-01. General. - All metals, unless otherwise specified, shall conform to applicable Federal Specifications, and, when not covered thereby, to applicable A.S.T.M. specifications. All castings shall have the pattern or mark number cast on them. Unless otherwise authorized by the contracting officer, the scale weights of each casting or forging after machining shall be within 5 percent of the weights as calculated from the dimensions specified or shown on the drawings. Castings shall conform, at the minimum section thereof, to the following dimensional tolerances: where embedded in concrete, to within 1/8 inch; where not embedded in concrete, to within 1/16 inch of the dimensions shown on the drawings.

10-02. Materials and workmanship. - a. The articles included in Items 17 to 20 inclusive, other miscellaneous materials, and all metal required in the work, except as otherwise specified, shall meet the requirements of the following specifications where applicable to the use intended:

(1) Steel reinforcement shall be of new billet intermediate grade, open-hearth steel, deformed, and shall conform to the Federal Specification QQ-B-71a for "Bars, reinforcement, concrete, Type 'B', Grade 2 (dated January 12, 1938)." Certified copies of any mill test required shall be furnished by the contractor and the steel shall be subjected to such tests as the contracting officer may consider necessary to establish its quality, including particularly the requirements of bending and elongation. The steel shall be free from oil, paint, dirt or excessive rust. Expanded metal reinforcement shall be used as shown on the drawings in the fire-proofing of steel beams. This reinforcement shall consist of a diamond shaped steel mesh manufactured from open-hearth steel, by a cold drawn process which will cut and draw the material so that uniform strands are formed at regular intervals along the length of the sheet with the plate intact between successive strands. It shall possess ductile properties which will permit any strands to be bent through an angle of 180 degrees over one diameter, without fracture, and to have a yield point of not less than 55,000 pounds per square inch. The size of the diamond shall be approximately 1-1/2 inches by 3 inches, and the weight per square yard shall be not less than 1.8 pounds.

(2) Structural steel. - Federal Specification QQ-S-71la; shapes, plates, bars, pins, and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise required. Welding will be accepted only where specified or authorized, and approved only when done in accordance with the current requirements of the American Welding Society.

(3) Cold-rolled steel. - A.S.T.M. Specifications A-108-36 for "Commercial Cold-Finished Bar Steels and Cold-Finished Shafting." Unless otherwise specified this material shall be used for rods, pins, keys, and similar parts.

(4) Hot-rolled steel for shafting, sleeves and rollers;- A.S.T.M. Specifications A-107-36 for "Commercial Quality Hot-Rolled Bar Steels."

(5) Machine steel; same as for Hot-rolled steel.

(6) Steel, corrosion-resisting; Federal Specification QQ-S-763 or QQ-S-766.

(7) Steel forgings shall be of hot-rolled open-hearth steel forging bars conforming to A.S.T.M. Specifications A-18-30 for carbon steel and alloy steel forgings, Class "C", except that shafts of this material not otherwise specified shall be S.A.E. No. 1045 hot-rolled, open-hearth steel forging bars.

(8) Steel castings; - Federal Specification QQ-S-681a.

(9) Iron castings, gray; - Federal Specification QQ-I-652, class as indicated. Tensile tests and chemical analysis will not be required.

(10) Malleable iron castings; - Federal Specification QQ-I-666, Type "A".

(11) Steel rail track and fittings shall be standard A.S.C.E. sections and shall conform to the A.R.E.A. standard specification for carbon steel rails.

(12) Chains and attachments; - Federal Specification RR-C-271 of Type "A" and Grade "2" unless otherwise specified.

(13) Bolts, screws, and washers; - Federal Specification FF-B-571a and current standard practice, unless otherwise specified.

(14) Wrought iron bars and shapes; - Federal Specification QQ-I-686, Grade "B".

(15) Wrought iron pipe; - Federal Specification WW-P-441a.

(16) Cast iron pipe; - A.S.T.M. Specifications A-44-04, Class "A"; for soil pipe refer to Federal Specification WW-P-401.

(17) Black steel pipe and fittings; - Federal Specification WW-P-403a, Type "A", and WW-P-521.

(18) Sheet copper; - Federal Specification QQ-C-501, Type "V", Class "A".

(19) Zinc coatings (hot galvanized); - Federal Specification QQ-I-696.

(20) Babbitt metal; - Federal Specification QQ-M-161.

(21) Classes C and D bronze for slide gate seats shall have the following chemical properties:

	Class C	Class D
Copper (percent)	82.00 to 83.00	
Tin (")	6.75 to 7.50	Federal Spec.
Lead (")	4.50 to 5.00	QQ-B-691a, No. 6
Zinc (")	5.00 to 6.00	

(22) Lead; - Federal Specification QQ-L-171, Grade A.

(23) Solder; - Federal Specification QQ-S-551.

(24) Valves; - Federal Specification WW-V-76a.

b. Other items, unless otherwise specified, shall conform to current standard practice for the material required and use intended.

10-03. Galvanizing and painting. - a. Galvanized iron or steel articles shall be galvanized by the hot-dip process unless otherwise permitted. Injuries to the galvanizing shall be satisfactorily repaired. Provision shall be made for protecting threads either by counterboring fittings, so as to cover threads or by cutting threads so as to make a very loose fit before galvanizing and carefully rerunning threads after galvanizing so as to leave a good coating all over threads. Hot glavanizing shall be of such quality as to endure at least 4 one-minute immersions in copper sulphate solution, in accordance with the requirements of the Preece Test.

b. Except as otherwise specified all ungalvanized iron and steel to be exposed in the finished work shall be thoroughly cleaned and then thoroughly and evenly painted, in accordance with the provisions of Section XVIII.

10-04. Miscellaneous iron and steel (Item 17). - a. Manhole and other frames, ladders, manhole steps, covers and other miscellaneous iron and steel items, as shown on the drawings, shall be furnished and installed. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the miscellaneous iron and steel work which he proposes to install.

b. Payment will be made as specified in Paragraph 10-07.

10-05. Miscellaneous pipe and fittings (Item 18). - a. Black steel or standard wrought iron pipe complete with malleable iron fittings and connections shall be furnished and installed on the structures where shown on the drawings. Pipe shall be of the size as shown on the drawings and shall conform to Federal Specifications WW-P-403a and WW-P-521. Pipe fittings and connections shall be malleable iron castings (see Paragraph

10-02 a(10)), of ball pattern and pin-connected where required; post connections at the floor, and caps used on the bottoms of sleeves embedded in the concrete shall be standard screw type. All fittings shall be of Crane Company type or equal. Floor or wall flanges of screw type shall be anchored into the concrete with stud type expansion bolts consisting of one primary and one secondary expansion unit similar and equal to that manufactured by Akerman Johnson Company. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the miscellaneous pipe and fittings which he proposes to install.

b. Payment will be made as specified in Paragraph 10-07.

10-06. Structural steel for service bridge (Item 19). - a. The structural steel items required for the bridge to the outlet structure shall be furnished and installed as shown on the drawings or as directed by the contracting officer. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the structural steel work which he proposes to install.

b. Payment will be made as specified in Paragraph 10-07.

10-07. Measurement and payment. - a. The quantities to be paid for under Items 17 to 19, inclusive, will be the number of pounds respectively furnished and installed in accordance with the drawings and specifications. Wherever practicable, the quantities shall be determined by weighing the articles and materials. When weighing is not practicable, the actual weight of each part of item involved will be determined by the contracting officer, who will use for that purpose manufacturers' weights, catalog weights, and computed weights. The weight of all tare, packing, and blocking will be deducted, using only net weights for payment quantities; provided, that no payment will be made for any weight in excess of 5 percent more than the computed weight as determined from the drawings.

b. In calculating computed weights the following unit weights of the several materials will be used unless otherwise specified:

Structural Steel	-	0.2833 pound per cubic inch
Cast Iron	-	0.2604 " " " "
Wrought Iron Pipe	-	The weight per linear foot shown in Table I of Federal Specification WW-P-441a.
Black Steel Pipe	-	The weight per linear foot shown in Table I of Federal Specification WW-P-403a.

c. Payment will be made at the applicable contract unit prices for Items 17 to 19 inclusive (see Paragraph 1-05).

10-08. Steel trash racks (Item 20). - a. Steel trash racks complete, including frames, angle iron guards and accessories, shall be furnished and installed as shown on the drawings. The steel trash racks, nuts,

bolts, rivets, and pipe spacers shall conform to the requirements of Federal Specification QQ-S-711a; shapes, plates, bars, and bolts shall be Class "A" and rivets shall be Class "C", unless otherwise shown. All frames and gurads to be attached to the concrete shall have anchors as shown on the drawings or as directed. The steel shall be painted as provided in Paragraphs 18-03 and 18-06. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the steel trash racks and accessories which he proposes to install.

b. Payment will be made at the contract price for Item 20, "Steel Trash Racks," and shall include all costs of furnishing and installing the trash racks complete with frames, guards and accessories as specified.

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SECTION XI. SLUICE GATES, COMPLETE WITH HOISTS (Item 21)

11-01. Work included. - a. The contractor shall design, furnish, and install one electric motor-operated seating pressure sluice gate, one electric motor-operated unseating pressure sluice gate and one hand-operated seating pressure gate as shown on the drawings, complete with hoists and accessories, all in accordance with the drawings and the specifications.

b. The contractor shall design, furnish, and install a removable sheet metal housing for each motor-operated gate hoist. The housing shall be constructed to slide down over the hoist and be secured in place, and shall be equipped with a door furnished with a lock to provide access to the motor control.

11-02. Description. - a. The gates shall be of cast iron with bronze seals, and shall be designed to operate satisfactorily under all heads up to and including the maximum hydrostatic head of 35 feet at the center of the unseating pressure gate and the hand-operated seating pressure gate and 15 feet at the center of the motor-operated seating pressure gate. The dimensions of the gate openings shall be as shown on the drawings. Each gate shall be operated by means of a rising-stem hoist actuated by an electric motor. Each gate shall seat or unseat satisfactorily under the maximum hydrostatic head. When seated the gates shall be practically water-tight.

b. The leaf of each gate shall consist of a rectangular cast iron plate with horizontal and vertical ribs. Bronze seat facings shall be driven into dovetail grooves machined in the face of the gates. The leaf shall have a pocket cast in the center near the top, heavily reinforced by ribs into which shall be fitted a solid manganese-bronze thrust nut, threaded and keyed to the stem. This thrust nut provides the attachment between the stem and the leaf and shall be of ample size to take the thrust both ways.

11-03. Seating pressure gates. - a. Leaf. - The leaf of each seating pressure gate shall conform to all the requirements of Paragraph 11-02 b and in addition each leaf shall have tongues on each side extending the full length of the leaf and these tongues shall be accurately machined all over. The leaf shall be not less than one inch thick and shall be suitably reinforced with horizontal and vertical ribs.

b. Frames and guides. - (1) The gate frames for the seating pressure gates shall be of the standard flat type having the rear face machined and drilled to attach to concrete and the front face machined to take the sluice gate guides. The frames shall be of cast iron of ample section to prevent distortion and shall be cast in one piece. Bronze seat facings shall be driven into dovetail grooves machined in the front face of the frame.

(2) The guides for the seating pressure gates shall be of cast iron of sufficient length so that not less than one-half of the gate is within the guides when the gates are fully open. Slots shall be machined the full length of the guides, of such dimensions, that there is not over 1/16-inch clearance with the tongues on the side of the leaf. The guides shall be machined to fit the frame and shall be bolted to the frame with steel studs and keyed to the frame to prevent lateral movement. Holes for studs shall be spot-faced.

11-04. Unseating pressure gate. - a. Leaf. - The unseating pressure gate leaf shall conform to all the requirements of Paragraph 11-02 b, and in addition shall be fitted with seven wedges on each side with four top and four bottom wedges. The leaf shall have tongues on each side extending the full length of the leaf and these tongues shall be accurately machined all over. The side wedges shall be of solid bronze and shall be of the adjustable type, and shall be provided with tongues on the back to slide in vertical keyways, machined in the leaf, and shall be secured to the leaf by shouldered steel studs and bronze nuts. They shall have solid bronze adjusting bolts. The side wedges shall be machined on all bearing surfaces and shall make accurate contact with the bronze wedge facings attached to the guides. The top and bottom wedges shall be of solid manganese-bronze and shall be of the adjustable type. The wedges shall be attached to the leaf by shouldered steel studs and bronze nuts and shall have solid bronze adjusting bolts. The wedges shall be machined on all bearing surfaces and shall make accurate contact with the wedge seats attached to the frame. The leaf shall be not less than one inch thick and shall be suitably reinforced with horizontal and vertical ribs.

b. Unseating pressure gate frame and guides. - (1) The gate frame for the unseating pressure gate shall conform to all the requirements of Paragraph 11-03 b(1) except that it shall be of the standard flanged type.

(2) The guides for the unseating pressure gate shall conform to all the requirements of Paragraph 11-03 b(2) and in addition shall be reinforced with heavy ribs at points of contact with the side wedges of the leaf, capable of taking the whole thrust due to water pressure and wedging action. Heavy bronze wedge facings shall be attached to the guides at points of contact with the side wedges and these wedge facings shall be machined on all bearing surfaces and shall make accurate contact with the side wedges.

11-05. Gate stems. - a. The gates shall have rising stems of sufficient size to withstand safely, without buckling, the whole thrust due to closing the gate under the maximum operating head. The gate stems shall be cold-rolled steel in sections not exceeding 10 feet in length. The sections of each stem shall be joined together by solid manganese-bronze couplings threaded and keyed to the stems.

b. Each stem shall be furnished with stem guides so that the unsupported length of stem shall not exceed 10 feet. All stem guides shall be bronze bushed and adjustable.

11-06. Electric hoists. - a. General. - The gate hoists shall be electric motor-operated, pedestal type, one for each of two gates as shown on the drawings, complete with electric motor and controls, stems, stem guides, stem pipe covers and bracing, accessories and position indicator, and shall be sufficient in capacity to raise and lower the gates against the maximum operating head.

b. Description. - (1) Two sluice gates shall be operated by an electric motor-operated hoist designed to lift the gates against the head for which they are designed (see Paragraph 11-02 a). The hoists shall have a minimum stem raising and lowering speed of one foot per minute.

(2) The pedestal and gear case shall be made waterproof and shall be constructed of high grade cast iron with provisions made for attaching stem cover to top cover plate. A suitable torque plate shall be provided at the base of the pedestal. Electric contactor cases and push button cases shall be cast as integral parts of the pedestal and shall have cast iron covers with machined and gasketed watertight and dust-tight joints.

(3) All gears shall be of steel properly designed for the service intended. The gear shafts shall be provided with bronze bushings. Gearing shall be enclosed in watertight and dust-tight casings and shall be so designed that it will not be necessary to run the gears in oil or grease. Spur gearing shall be used. The stands shall include automatic mechanical hammer-blow devices or other apparatus to allow the motor to come up to speed before unseating the gate.

(4) A handwheel with disconnecting handle, and connected to the stem by suitable gearing, shall be provided for hand operation of each hoist. The handwheels shall not revolve when the hoists are electrically operated, and the motors shall be automatically prevented from starting when the hoists are being hand-operated, or when the "hand-motor" handles are in the "hand" position.

(5) Suitable visual indicators shall be provided so that the exact position of the gates can be determined at all times.

(6) The hoists shall be equipped with stem covers of threaded wrought iron pipe with suitable caps.

c. Gate hoist electrical equipment. - (1) The hoist motor shall be mounted on the pedestal and arranged so that the controls are built in, completely enclosed and waterproof. The motor shall be direct connected through a train of spur gears and shall be the single speed, high torque, low starting current type. The motor shall be designed for 220-volt, 3-phase, 60-cycle current to operate at a speed of not over 900 r.p.m. It shall be of the squirrel cage type, rated for 30-minute operation and shall be equipped with all necessary starting apparatus and protective devices. The starting torque of the motors at

rated voltage and frequency shall be not less than 250 percent full-load torque. The motor shall be equipped with grease-packed ball-bearings and splash-proof housing. Insulation shall be impregnated with special moisture-and acid-resisting compound.

(2) The controllers shall be of the full magnetic reversing type, designed for across-the-line starting; and controlled by a three-way push-button station, so that the gates may be raised, lowered, or stopped at any desired point in their travel. The controllers shall be provided with undervoltage, inverse-time-limit and instantaneous overload protection accomplished by suitable relays. Overload relays shall be of the automatic reset type. The limits of travel of the gate in both upward and downward directions shall be accurately determined by quick-break limit switches geared directly to the gate stems. The switches shall be designed to absolutely prevent "drift" or jamming of the gate. The switches shall be housed in water-proof and oil-tight cases and shall be equipped with quick-break contacts with micrometer adjustment. Each hoist shall contain a motor contactor equipped with separate "open" and "close" contactor arms, mechanically interlocked, and provided with arc shields. The contactor shall be of ample size and rating to make and break the current required by the motor under all conditions. Push buttons in watertight cases shall be provided. The push buttons shall be clearly labeled "open," "close" and "stop." A pilot light shall be installed, indicating that the motor is ready to be operated. All electrical apparatus shall be installed, and internal connections shall be made by the hoist manufacturer.

(3) Wiring shall be complete as shown on the drawings and shall be placed in suitable ducts. Wires shall be insulated with approved "Heat-Resistant" insulation. The wiring shall terminate at a suitable enclosed terminal board.

(4) The hoist shall have a hoisting speed with the electric motor of not less than 1 foot per minute. A gate-position indicator shall be included on the hoists. The gate-position indicator shall be plainly visible from the push-button station.

(5) Unless otherwise specified, all electrical materials, workmanship, and tests shall be in conformity with the current standard rules, regulations, and specifications of the American Institute of Electrical Engineers and of the National Electrical Manufacturers Association.

11-07. Hand hoist. - a. The gate hand hoist shall be a two-speed unit designed and built for hand operation of sluice gates, and shall be of sufficient capacity to raise or lower the gate against the maximum operating head with not more than a 40-pound pull on the crank. The hoist shall be made of cast iron conforming to Federal Specification QQ-I-652. A standard indicator shall be provided with the gate hoist.

b. The pedestal and gear cases shall be made of cast iron conforming to Federal Specification QQ-I-652. The operating nut shall be of cast bronze and all gears shall be of steel of sufficient strength and properly designed for the service required. The hoist shall be equipped with two single row ball thrust bearings; one above and one below the operating nut. The gear shafts shall be provided with bronze bushings.

11-08. Furnishings and fittings. - a. The gate frames, guides and hoists shall be designed and constructed to provide a satisfactory method of fastening them securely to concrete or other supports during erection as shown on the drawings. All bolts, special tools, and other devices necessary to erect the gates, frames, guides, and hoists as shown on the drawings shall be furnished by the contractor.

b. All bolts, nuts, screws, studs, pins, etc., shall be securely locked by satisfactory devices that will prevent loosening due to vibration.

11-09. Design. - a. The detailed design for the sluice gates, hoists, and accessories shall be such that all working parts shall be readily accessible for inspection and repair, easily duplicated, and readily replaced. Each and every part of the equipment shall be properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall not be greater than one-sixth of the ultimate strength of the material used.

11-10. Drawings. - The contractor shall submit for approval detail drawings for the sluice gates, hoists, and accessories he proposes to install in sufficient detail to check the design. These drawings shall be in accordance with Paragraph 1-04 and shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details or by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications shall be supplied by the contractor whether or not the same is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the contractor shall become a part of these specifications.

11-11. Materials and workmanship. - Each gate, with its hoist and accessories, shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the contractor and approved by the contracting officer, and shall conform to the provisions of Section X, where applicable. All metal workmanship shall be of approved standard quality.

11-12. Installation. - Each gate shall be completely assembled during installation and the leaf shall be screwed lightly into its seat and shall be held in place by jack screws. Care shall be exercised when drawing the frame up to the concrete to insure its being pulled against a true surface. All bolts shall be tightened carefully so as not to strain or warp the parts and to preserve proper alignment. Grout shall be poured between the face of the flange and the concrete to prevent any tendency to spring the frame. After installation, the jack screws shall be removed.

11-13. Inspection and tests. - a. The gates, hoists and accessories to be furnished shall be assembled in the shop as directed by the contracting officer for inspection and to insure that all parts fit accurately and are in proper alignment. Each gate shall be opened and closed to insure proper operation.

b. After completion of the pumping station and the installation of all machinery, each gate shall be tested for satisfactory operation by being raised and lowered several times for its full length of travel. Any adjustments in the setting or installation required to secure satisfactory operation and tight closure of the gates shall be made by the contractor. The gate hoists shall be tested as directed and any adjustments or changes that may be required in the opinion of the contracting officer shall be done by the contractor.

c. The cost of all testing shall be borne by the contractor, except for the Government's representatives, and shall be included in the contract price for Item 20.

11-14. Painting. - a. Painting shall conform to the applicable provisions of Section XVIII.

b. For gates and gate guides there shall be one coat of metal filler, one shop coat of red lead and one field coat of red lead paint, and two finish coats of graphite paint. Painting shall be similar and equal to Detroit Graphite Company's Iron-Gard System for Underwater steel structures.

c. For gate hoists there shall be applied one coat of metal filler, one shop coat of red lead, one field touch-up coat of red lead if found necessary by the contracting officer, and two coats of selected engine enamel.

11-15. Payment. - a. Payment for designing, furnishing, painting and installing the work included in Paragraph 11-01 will be made at the contract price for Item 21, "Sluice Gates, Complete with Hoists."

b. Partial payments up to 50 percent of the contract price will be made when the sluice gates, complete, are delivered to the site of the work provided the quality of such equipment is satisfactory to the contracting officer, but in no case will the payment to the contractor

exceed the cost of the equipment delivered to the site of the work. The equipment shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

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SECTION XII. HEATING AND VENTILATING EQUIPMENT (Item 22).

12-01. Work included. - a. The contractor shall furnish, install, and place in operation the steam heating equipment and the engine-room and pump-room ventilating equipment. The steam heating system shall be of the two-pipe, gravity type consisting essentially of a combination boiler and oil burner unit, a 500-gallon fuel oil storage tank, and two unit heaters located in the engine-room, together with steam piping, valves, and all accessories and appurtenances herein required or shown on the drawings. The ventilating equipment shall consist essentially of a fan located on the roof of the pumping station and a blower with connecting duct work, located on the engine-room floor. All piping and connections shall conform to local laws and regulations.

b. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the heating furnace, fuel pump, fuel tank and piping which he proposes to install. The contractor shall also furnish descriptive data on the unit heaters, ventilating fans, motors and controllers which he proposes to install.

12-02. Boiler-burner. - The boiler-burner shall be a Timken Oilboiler Model TA-127 or equal complete with insulated jacket relief valve, gauge glass, and pressure gauge. The boiler shall have a capacity of not less than 840 square feet of net installed steam radiation. The burner motor shall be equipped with a thermal overload protective device, similar or equal to Arrow-Hart & Hegeman Electric Company motor control catalog No. 1385 for flush mounting, which may be used as a switch, and shall be suitably located. This protective device shall also provide protection for the fuel-pump motor.

12-03. Unit heaters. - Each unit heater shall be a Herman Nelson Hijet Model 1402, as manufactured by Herman Nelson Corp. or its equal. Each unit shall have a capacity of 98,000 B.t.u. per hour at a 2-pound steam pressure, 60 deg. F. entering air, and fan speed of 1,750 r.p.m. The fan motor shall be suitable for operation on 120-volt, single-phase 60-cycle A. C. power. It shall be of the two-speed type, equipped with controller and thermal overload starting switch.

Each unit heater shall be equipped with a pressure type control, so wired that the fan motor will not be permitted to operate during normal operation of the heating system, unless steam is present in the heater.

Each heater shall be fitted with a No. 75 Hoffman float type air valve or equal, and a Crane No. 34 Standard brass swing check valve or equal. Gate valves shall be Crane No. 438 or equal standard brass gate valves.

12-04. Control equipment. - The following control equipment as manufactured by the Minneapolis-Honeywell Regulator Co., or equal, shall be provided.

1 - Thermostat - T11A Acratherm equipped with a thermometer graduated from 20 degrees Fahrenheit to 120 degrees Fahrenheit.
2 - Pressuretrols - P404-B (Unit Heaters)
1 - Pressuretrol - L404A (Steam Boiler)
1 - Protectorelay - R117A (Stack)

The boiler shall be equipped with a No. 67 low water cut-off and a No. 101 electric water valve as manufactured by the McDonnell-Miller Co., or equal. Provision shall be made to by-pass the water valve in order that the boiler may be manually fed.

12-05. Fuel tank and piping. - a. The fuel oil tank shall be a 500-gallon, 1/4-inch, welded steel tank 3-1/2 feet in diameter and 8 feet long set on concrete supports underground and suitably anchored as indicated on the drawings. The fill line (2 inches) and vent line (1-1/4 inches) shall be of standard weight, galvanized, wrought iron pipe with galvanized malleable iron fittings. A vent cap shall be provided on the vent line and the fill pipe shall have a lock type fill connection.

b. The suction line from tank to fuel oil pump shall be 3/8 inch (1/2 inch O.D.) Type "K" soft annealed copper tubing. It shall be fitted with a valve ahead of the pump. The return line from pump to fuel oil tank shall be 1/2 inch (5/8 inch O.D.) Type "K" soft annealed copper tubing. The feed line from pump to burner shall be 3/8 inch (1/2 inch O.D.) Type "K" soft copper tubing, fitted with a shut-off valve at the pump, and a Ryan fusible valve, or equal, at the burner. The horizontal run from pump to burner shall be encased in wrought iron pipe sleeves embedded in the concrete floor.

c. The fuel oil pump shall be a Kraisel-Trumbull Model 522 or equal, and shall be located on the inside of the boiler room wall as shown on the drawings. The overflow connection on the pump must be located at an elevation higher than the top of the tank. A constant level valve shall be supplied in the burner feed line at a point not over 5'-0" above the boiler room floor.

d. Tubing to outside tank shall be provided with a swing at the tank for settling and both lines shall pitch toward the tank.

e. Unless otherwise specified, all fuel oil piping materials, workmanship and tests shall be in conformity with the current standard rules, regulations and specifications of the National Board of Fire Underwriters, Chicago, Ill.

f. The steam piping shall be standard weight black wrought iron pipe with cast iron fittings. The steam main shall be supported from the engine room wall on Crane No. 2816 or equal, welded steel brackets and Crane No. 2738 or equal, steel pipe hangers with 1/2-inch rods. Steam lines in other locations shall be hung on Crane No. 2738 or equal, hangers with 1/2-inch rods and concrete inserts. The steam lines shall be supported

at least every ten feet. All steam supply and return piping shall be covered with 85 percent magnesia one inch thick. Fittings shall be covered with one inch of 85 percent magnesia plaster. All pipe insulation shall be sized and painted with two coats of paint as selected by the contracting officer.

12-06. Engine-room ventilation. - The engine room shall be ventilated by an electric-powered fan located on the roof. The fan shall be a Davidson No. 22 N.T.D. or equal high duty, copper-housed fan with self-acting louvers, driven by a 3-speed 60-cycle A.C. motor suitable foroperation on 120 volts. The fan shall have a capacity of 4,435 cubic feet of standard air per minute. The motor shall have a controller and a thermal overload starting switch located on the engine room wall 4'6" above the floor.

12-07. Pump-room ventilation. - The pump room shall be ventilated by a blower located on the engine-room floor with an intake duct run down to a point approximately one foot below the engine-room floor and a discharge duct run out through the outside wall, as shown on the drawings. The blower shall be a No. 150 American Blower Utility set or equivalent, driven by a single-phase, 60-cycle A.C. motor suitable for operation on 120 volts. The blower shall have a capacity of 1,430 feet of standard air per minute. The motor shall have a controller and a thermal overload starting switch located on the engine-room wall. The intake duct shall be a 9-inch round, 20-gauge galvanized iron duct supported from the engine-room floor. The discharge duct shall be a 9-inch round, 20-gauge galvanized iron duct connected to a 24-inch by 45-inch louver, set in the outside wall.

12-08. Operation and tests. - After the heating and ventilating equipment has been installed, the contractor shall place it in operation and shall operate it for such length of time in such a manner as to satisfy the contracting officer that it meets all the requirements of the specifications.

12-09. Payment. - Payment for furnishing, installing, and placing in operation the heating and ventilating equipment will be made at the contract price for Item 22, "Heating and Ventilating Equipment". Partial Payment up to 50 percent of the contract price will be made when the heating and ventilating equipment is delivered to the site of the work provided the quality of such equipment is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The equipment shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

SECTION XIII. ELECTRIC LIGHT AND POWER SYSTEM (Item 23)

13-01. Work included. - a. The contractor shall furnish and install complete and ready for operation, all equipment and wiring for the electric light and power system of the pumping station as indicated on the drawings and as required by these specifications. The contractor shall make all necessary connections to the gasoline-electric generating unit and the switchboard, all pump motors, sluice-gate motors, and motors for heating and ventilating, and shall furnish and install all wiring, conduits, outlets, fixtures, lamps, floodlight projectors, switchboard, lighting panelboards, control equipment, fittings, and junction boxes.

b. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the switchboard and its equipment, lighting distribution panelboards, floodlights, lighting fixtures, conduits, wiring and accessories which he proposes to install. A conduit and wire size schedule shall also be submitted for approval.

13-02. General description. - a. The complete power system includes conduits, wires, switchboard, control equipment, all wire connections of external circuits to the several parts of the operating equipment and the grounding system.

b. The lighting system includes fixtures, lighting panelboards, combination metering transformer and switch boxes, floodlight projectors, switches, receptacles, lamps, conduits and wires for lighting.

c. The battery-charging system includes conduit and wire for battery-charging, battery charger with controls and meter for charging the battery on each gasoline engine through the wire and conduit brought up to each engine panel, and connections to battery-charging equipment at the switchboard.

d. The pumping station will normally be supplied with electrical energy at 115 and 230 volts, three phase, 4 wire A. C. from an outside source. The contractor shall furnish and install the incoming feeder, as covered by Paragraph 13-05 b, from the service entrance box in the pumping station to the Power Company's pole from which power will be supplied to the pumping station. A standby generator will supply power to the pumping station in case of an interruption of the normal source of power supply.

e. The electrical equipment throughout shall be so designed that it will not be effected by wide changes in temperature and moisture produced as a result of condensation.

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13-03. Standard rules and specifications. - a. Unless otherwise specified, all electrical materials, workmanship, and tests shall conform with the current standard rules, regulations, and specifications of the following authorities:

(1) American Institute of Electrical Engineers, 33 West 39th Street, New York, N. Y.

(2) National Board of Fire Underwriters, National Electrical Code, 85 John Street, New York, N. Y.

(3) National Electrical Manufacturers Association, 155 East 44th Street, New York, N. Y.

(4) Bureau of Standards, National Electrical Safety Code, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

(5) Insulated Power Cable Engineers Association, 420 Lexington Avenue, New York, N. Y.

(6) Federal Specifications cited herein (Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.).

(7) The Hartford Electric Light Company, Hartford, Conn.

b. Copies of these rules, regulations, and specifications may be procured at the addresses as given, or may be seen at the U. S. Engineer Office, Providence, R. I.

13-04. Conduits. - a. Conduits shall be located as indicated on the drawings or as directed by the contracting officer.

b. The conduits shall be hot-dip galvanized or sherardized on both inside and outside, and shall meet the requirements of Federal Specification WW-C-581a for "Conduit, Steel, Rigid, Zinc-coated". Conduit fittings or bodies shall be galvanized, sherardized or cadmium-plated high-test gray iron castings of the types and sizes specified or shown on the drawings, or required for the work to be done. They shall be approved by the National Board of Fire Underwriters, and be similar and equal in all respects to those manufactured by the Crouse-Hinds Company. Conduit sizes shall meet the requirements of Article 346 of the 1940 edition of the National Electrical Code with the exception that no conduits smaller than 3/4 inch shall be used.

c. The installation of conduits shall comply with Article 346 of the 1940 edition of the National Electrical Code. All wires and cables

shall be run in rigid conduits forming a complete raceway from the cabinet or panel to the last outlet in the system. Conduits shall be run concealed in the floors and ceilings or run exposed on the walls as indicated on the drawings. Conduits in masonry walls and floors shall be built-in complete with all necessary fittings at the time the masonry is being placed. All exposed conduits shall be securely fastened and anchored to the structural portions of the building and shall be run parallel with or at right angles to the walls. All conduits shall be run with long-radius bends where possible, and not more than the equivalent of three 90 degree bends shall be used on any run. All bends shall have a minimum radius of six diameters. If more than three bends are required, pull boxes shall be installed at points approved by the contracting officer. All conduit ends shall be reamed to remove burrs and obstructions after the threads have been cut. All conduit joints shall be made watertight with an approved sealing compound. At all conduit terminals there shall be provided approved bushings or conduit fittings. All metal conduit runs shall have electrical continuity. Open conduit ends shall be capped in an approved manner, to exclude dirt and moisture. No threadless fittings or running-thread couplings shall be used on runs of conduit. As soon as possible after the concrete has set, each conduit shall be cleaned, inspected, and tested by the contractor to ascertain its mechanical and electrical continuity, and freedom from obstructions. Any defects in material or workmanship shall be remedied immediately as directed by the contracting officer. After each duct line is completed, the contractor shall inspect and test conduit in an approved manner and the conduit ends shall be capped.

13-05. Wiring. - a. The contractor shall furnish and install all wire and cable, terminals, junction boxes, supports, hangers, make all connections, grounds, and properly place, arrange, and identify all material as specified or directed by the contracting officer. All wiring shall be in rigid conduit unless otherwise specified, shown on the drawings, or directed by the contracting officer.

b. The contractor shall furnish and install the incoming service feeder. The service feeder from the power company's pole approximately 100 feet from the pumping station to the outside service entrance conduit at the pumping station shall be four 300,000 CM single conductors, R.C.T.B. 600 volt, A. C. Insulation with a different colored braid on each conductor. The contractor shall also furnish and install a suitable rack with strain insulators mounted on the building wall just above the service entrance conduit. The service entrance conduit weatherhead and cable as shown on the drawings shall be furnished and installed by the contractor. The terminal rack on the building shall be located to suit the incoming feeders from the power company's terminal pole. The feeders shall be suspended free from any obstacles.

c. The motor feeders from the switchboard to the outside gate-hoist motors shall be three-conductor No. 10 A.W.G., lead covered

cable, rated at 600 volts, 60 cycles, A.C. and shall conform to Federal Specification J-C-106a "Cable and Wire; Rubber-Insulated, Building-Type, Heat Resistant Grade (0 to 5,000-volt Service)."

d. All wire used shall be copper, soft drawn and annealed and having not less than 95 percent conductivity. Wire sizes shall comply with Article 300 of the 1940 odition of the National Electrical Code. No wire shall be used that is smaller than No. 12 A.W.G. Insulation for all wires and cables shall be flame-retarding and moisture proof and shall conform to Federal Specification J-C-106a for "Cable and Wire: Rubber Insulated Building Type, Heat Resistant Grade (0 to 5,000-volt Service)."

e. All wire and cable shall be shipped on reels or in coils, plainly marked for complete identification, including the wire or cable size, number of conductors, length, weight, thickness, character of the insulation and the name of the manufacturer.

f. Materials used in the wiring shall conform to the following requirements:

(1) Solder for splicing or wiping shall conform to Federal Specification QQ-S-571, for "Solder Tin Lead," Grade "A" for sweat conductor joints.

(2) Solder for brazing shall conform to Federal Specification QQ-S-511, for "Solder, Brazing," Composition "B".

(3) Silver solder shall conform to Federal Specification QQ-S-561b for "Solder, Silver," Grade "0".

(4) Rubber tape shall conform to Federal Specification HH-T-111 for "Tape, Rubber Insulating."

(5) Friction tape shall conform to Federal Specification HH-T-101 for "Tape, Friction," Grade "A".

(6) Cotton tape shall conform to United States Navy Department Specifications 17-T-15 for "Tape, Insulating, Linen Finish, Plain," thickness .007 inch.

13-06. Grounding. - Permanent and effective ground connections shall be provided for neutral of power supply, generator, all metal cabinets enclosing electrical equipment, for equipment frames and housings, continuous runs of metal conduit, and elsewhere to comply with Article 250 of the National Electrical Code, and as specified or directed by the contracting officer. The contact area of all joints in grounding circuits shall provide a current carrying capacity not less than that of the connecting wire or cable, and the joints shall be bolted or brazed, as specified or as directed. All ground connections to equipment that may require removal for maintenance or repair shall be bolted to the equipment.

13-07. Lighting and outlets. - a. The lighting panelboards, fixtures, plug receptacles, tumbler switches, lamps and outlet boxes shall be installed as specified and at locations indicated on the drawings and shall be in accordance with the description as shown on the Bill of Material. The installation in the pump room shall be explosion-proof.

b. Lamps, including those for floodlights, shall be rated at 115 volts and of the watt rating shown or specified and shall conform to Federal Specification W-L-101c for "Lamps, Electric, Incandescent, Large, Tungsten-Filament."

c. All lighting fixtures shall be installed as specified and at locations indicated on the drawings and shall be similar and equal to that specified in the Bill of Material. All fixtures shall be installed at locations as shown and conduit shall be run in the structural portion of the concrete slab as shown on the drawings.

d. Two floodlights shall be located on the roof parapet as shown on the drawings and shall be made adjustable so that the dike and storage pond will be well-lighted. They shall be similar and equal to Crouse-Hinds ADE-16 Catalog No. 42932 each equipped with a narrow-beam, polished, Alzak reflector and a spread lens capable of giving the light beam a spread of 34-1/2 degrees horizontally and 14-1/2 degrees vertically. The lamp for each floodlight shall be type PS-52 rated at 1000 watts, 115 volts, 60 cycles, A.C. They shall have standard type mounting and be fitted with a locking handle and adjustable horizontal stops.

e. All sockets, switches, and receptacles shall be National Electric Code Standard and shall be in accord with the description as shown on the Bill of Material.

13-08. Miscellaneous electrical equipment. - a. The lighting panelboards shall be of the flush type with 115/230 volt, 3-wire solid neutral mains, and 115-volt, 2-wire branches with single-pole, automatic circuit breakers in each circuit. The panelboards shall be similar and equal to Westinghouse Type NA1B and shall be in compliance with Federal Specification W-P-131.

(1) The boiler-room panelboard shall be equipped with four single-pole, 250 volt, 15 ampere, automatic circuit breakers, one in each branch circuit.

(2) The engine room panelboard shall be equipped with eight single pole, 250 volt automatic circuit breakers, five to be rated at 15 amperes and three to be rated at 25 amperes.

b. An incoming junction box and service switch with metering equipment shall be provided in the boiler room as shown on the drawings. The metering equipment only will be furnished by the utility but shall be installed by the contractor. The incoming power switch shall

be three pole, single throw, fused, 400 ampere capacity rated at 600 volts, 60 cycles, A.C. and shall be a type which will meet the requirements of the Hartford Electric Light Company's standard for this type of work. The switch shall be designed for surface mounting and provided with external operating handle. The contractor shall familiarize himself with the meter installation standards of the Hartford Electric Light Company and shall furnish and install all equipment necessary to meet their standard installation.

13-09. Switchboard. - a. The contractor shall furnish and install in the engine room at the location indicated on the drawings a three-panel, free-standing, safety, steel-enclosed, dead-front type switchboard with removable cover plates at the sides and rear. This switchboard shall provide electric power control for the entire pumping station.

b. Facing the switchboard from the front, the panels left to right shall be arranged in a continuous row in the order named below. Each panel shall control the circuits listed.

(1) Panel No. 1.

Combined generator, exciter, and regulator panel for gasoline-electric standby generating unit. Capacity: 125 KVA at 80 percent power factor, 208/120 volts, 3-phase, 4-wire, 60 cycles, A.C. with 125-volt, D.C. direct-connected exciter.

Incoming feeders from the standby generating unit and the outside power source.

(2) Panel No. 2.

One feeder, 230 volts, 3-phase, 60 cycles, A.C. to the stator of the wound rotor induction motor for the 20-inch pump.

One feeder made up of control conductors from the drum controller to the rotor windings of the 20-inch pump motor.

One feeder made up of control conductors from the drum controller to the secondary resistor mounted on the wall.

(3) Panel No. 3.

One feeder, 230 volts, 3-phase, 60 cycles to the sump-pump motor.

Two feeders, 230 volts, 3-phase, 60 cycles, A.C. to the gate-hoist motors.

Two feeders, 115 volts, single phase, 3-wire, 60 cycles, A.C. to the lighting panelboards.

One feeder, 115 volts, single phase, 60 cycles, A.C. for the battery charger input.

One feeder made up of battery charging conductors to the various storage batteries.

One feeder, 115 volts, single phase, 60 cycles, A.C. to the two floodlights located on the roof parapet.

c. The panels shall contain the following equipment:

(1) Panel No. 1.

One voltage regulator complete with all necessary auxiliary equipment.

One mounting for exciter-field rheostat (furnished under Section XIV, Item 24).

One wattmeter 0 to 120 kw.

One voltmeter 0-300 volts, 60 cycles, A.C. with selector switch (see Paragraph 13-11 a), for reading the phase voltage and voltage to neutral of the generator and the phase voltage and voltage to neutral of the incoming line from the outside power source complete with the necessary fuse cut-outs and fuses.

One ammeter, 0-30 amperes, D.C. for reading the generator field current.

Two 300 ampere, 600 volt three-pole air circuit breakers with an interrupting capacity of 25,000 amperes for the 125 kva. standby generator and the outside power source each provided with three instantaneous and three time-delay magnetic over-current trips and magnetic lockout attachments.

One ammeter, 0-300 amperes, 60 cycles, A.C. with three current transformers and 3-phase selector switch for reading three-phase currents.

(2) Panel No. 2.

One 225-ampere 600 volt, three-pole air circuit breaker, provided with two suitable thermal-overload and two instantaneous short-circuit trips for the wound rotor induction motor for the 20-inch pump.

One magnetic contactor with suitable thermal-overload trips and hand reset button for the primary of the wound-rotor induction motor.

One start-stop push button station for operating the contactor.

One drum controller with visual indicator for varying the external resistance in the rotor circuit of the motor for the 20-inch pump.

(3) Panel No. 3.

One 15-ampere, 600 volt three pole air circuit breaker provided with two suitable thermal-overload and two instantaneous magnetic short-circuit trips for starting the sump-pump motor.

One 75 ampere, 250 volt single-pole air circuit breaker provided with suitable thermal-overload and instantaneous short-circuit trips for the output of the battery charger.

One battery charger complete with control equipment.

Five ammeters, 0-15 amperes for indicating the output of the battery charger to each storage battery.

Five rheostats for varying the input current to each of the five storage batteries.

Two 25-ampere, 600 volt three-pole air circuit breakers provided with two suitable thermal-overload and two instantaneous short-circuit trips forthe two gate-hoist motors.

One 50-ampere, 600 volt, two pole air circuit breaker provided with suitable thermal-overload and instantaneous short-circuit trips for the feeder to the engine-room lighting panelboard.

One 25-ampere, 600 volt, two-pole air circuit breaker provided with suitable thermal-overload and instantaneous short-circuit trips for the feeder to the boiler room panel board.

One 25-ampere, 250 volt, single pole air circuit breaker provided with suitable thermal-overload and instantaneous short-circuit trips for the feeder to the floodlights located on the roof parapet.

One 15-ampere, 250 volt, single pole air circuit breaker provided with suitable thermal-overload and instantaneous short-circuit trips for the A.C. feeder to the battery charger.

13-10. Construction of switchboard. - a. Panels. - The switchboard shall be of the dead-front totally enclosed type of construction conforming to the standards of the N.E.M.A. All panels shall be of 1/8-inch "Stretcher-leveled" steel with a 1/4-inch radius bevel on all front edges and of equal width. Panels shall have rolled edges. The width of the panels shall be such as to give a compact and neat arrangement of the equipment without sacrificing efficiency and accessibility in the operation and maintenance of the switchboard. The panels shall be bolted to the switchboard frame and each shall be subdivided into vertical sections which

may be removed to give access to apparatus on the subpanel. Slots shall be provided to accommodate the handles of switches and breakers. There also shall be provided on the front of the panel a visual indicator of the mechanical type to show the position of each switch or breaker. The indicator for the drum controller shall be marked "OFF," "1/2 Speed," "3/4 Speed," "Full Speed." No unsightly gaps or wide joints shall be visible in the completed assembly.

b. Rear cover plates. - The rear of the switchboard shall be enclosed by framed cover plates with a 1/4-inch radius bevel on outside edges, which shall run the full height of the switchboard and shall be arranged in convenient widths. One panel shall be in the form of a swinging door with lock and concealed hinges. The cover plates shall fit snugly and no gaps or wide joints shall be visible in the completed assembly.

c. Buses and wiring. - All power conductors shall be of the proper cross section for the currents to be carried and no wire shall be smaller than No. 8 A.W.G. All control wire on the panels shall be run in wiring gutters provided on the side of the panels and shall be brought out to terminal blocks when it leaves the panels. All buses shall be mechanically rigid and designed to carry the rated current to the circuit with a maximum temperature rise of 30 degrees C. The buss for the neutral conductor shall be mounted on insulated supports and grounded to the frame of the switchboard at one point only. Buses shall be marked to indicate their phase connection, i.e., 1, 2, 3 and ground.

d. Finish. - All steel work shall be Bonderized or given similar treatment, and given a dull black marine finish.

e. Name plates. - Suitable name plates shall be furnished for all circuits, controls and instruments. Name plates shall be black bakelite with white engraved letters.

f. A rubber insulating mat shall be furnished and placed in front of the switchboard. It shall extend the full length of the switchboard, and shall be 36 inches in width.

13-11. Switchboard equipment. - a. Air circuit breakers for the feeders from the standby generator and the outside power source shall be three-pole, single-throw, stationary mounting, trip-free, manually-operated, rated at 600 volts, 60 cycles, A.C. and having an interrupting capacity of 25,000 amperes. The air circuit breakers for the generator feeder and for the feeder of the outside power source shall be provided with three instantaneous and three time-delay magnetic overcurrent trips and a magnetic or mechanical lockout attachment on each circuit breaker. The magnetic lockout attachments on each shall be interconnected by means of auxiliary switches provided on the circuit breakers so that only one circuit breaker can be in the closed position at any time. The mechanical lockout attachments shall be interconnected by a shaft acting directly on the pole shaft so that only one circuit breaker can be in a closed position at any time.

b. Air circuit breakers for feeder protection of motors and equipment feeding from the main bus shall be provided with two suitable thermal-overload and two instantaneous magnetic short-circuit trips and shall be rated at 600 volts, 60 cycles, A.C., having an interrupting capacity of 10,000 amperes. The circuit breakers for the output side of the battery-charger and the floodlights shall be provided with suitable thermal-overload and instantaneous magnetic short-circuit trips and shall be rated at 250 volts.

c. The drum controller for varying the external resistance of the secondary winding of the wound-rotor induction motor driving the 20-inch pump shall be a non-reversing type, manually operated through a mechanism brought out to the front of the switchboard panel, provided with auxiliary contacts which are closed on "off" position only, and shall be similar or equal to the General Electric Company's type CR-3204. The starting handle shall provide for an "off", "1/2 speed", "3/4 speed", and "full speed" position marked on the mechanical indicator and as many intermediate positions as are necessary to give the motor smooth operation.

A magnetic contactor operated by a "Start" "Stop", momentary contact, push button station shall control the primary circuit of the wound-rotor motor for the 20-inch pump, and shall be interlocked with the "off" position of the drum controller so that the motor cannot be started without having all of the secondary resistance in the rotor circuit at the time of starting. The magnetic contactor shall be similar or equal to the General Electric Company's type CR-7006 complete with two manually-reset thermal relays.

The secondary resistors shall provide for speed-regulating and starting duty. The resistors shall consist of edgewise wound, non-breakable, non-corrodible type units clamped rigidly in place on insulated tie rods mounted in suitable end-frames, similar or equal to General Electric Company's type CR-3284. The resistors shall be mounted on the wall as indicated on the drawings and shall be arranged so as to provide a neat, compact assembly and to allow for efficient dissipation of the heat generated by the secondary currents. The resistors and controller shall provide control for the secondary of a standard 75 horsepower, 220 volt, 3-phase, 60 cycle, A.C. wound-rotor induction motor to be furnished by the Government. The "off" position of the controller shall provide for a closed circuit through auxiliary contacts from the push button station to the magnetic contactor and also provide to insert a sufficient amount of resistance in the motor secondary circuit to limit the primary current, with the rotor blocked, to a value not greater than 100% of full load current and produce sufficient torque to start the pump. A sufficient number of steps after the "off" position shall be provided to give the motor smooth operation to full speed and the secondary resistance inserted on each point shall be of the proper value to produce the required tongue at that speed. Definite values of resistance shall be provided, however, to produce one half, three-quarters and full load speed. The final step in the controller shall short-circuit the secondary resistance. The resistors for each step shall be rated for continuous operating duty.

d. Instrument switches for reading line voltage and currents shall be the rotary type and similar and equal to the General Electric Company type SB-1. The voltmeter switch shall be connected to read the voltage to neutral in one phase in addition to the three-phase voltages.

e. The voltage regulator shall be designed for automatic voltage control of the generator and arranged for operation in the exciter shunt-field circuit. It shall provide good regulation up to 150 percent of rated generator capacity and shall be similar and equal to type GDA-31 of the General Electric Company.

f. A battery charger of approved make shall be installed inside the switchboard. The output side shall be connected to the battery-charging system (described in Paragraph 13-02 c) and the input side shall be capable of operating at 115 volts, 60-cycle, A.C., and shall have sufficient capacity to charge five twelve-volt batteries in parallel with positive terminal grounded at a charging rate of 12 amperes each. It shall be provided with separate adjustment in the circuit to each battery for varying the charging rate from zero to maximum in at least 6 steps and a separate miniature rectangular ammeter to indicate the direct current output to each battery. The adjustment shall be operated from the front of the switchboard. The ammeters shall be flush mounted on the front of the switchboard.

g. All fuses shall be readily accessible and shall comply with Federal Specification W-F-791 for "Fuses, Cartridge, Inclosed, Non-Renewable."

h. Meters shall be rectangular, semi-flush mounted, have a five-inch scale and shall be similar and equal to the corresponding product of the General Electric Company. The wattmeter shall be the three element type to accurately read the power in unbalanced circuits. Direct current ammeters for reading the input to the batteries shall be miniature type.

13-12. Motor control for the sump-pump motor shall consist of an enclosed magnetic across-the-line starter similar and equal to the Westinghouse Electric and Manufacturing Company's Class 11-200, push-button operated and arranged to provide thermal overload and under-voltage protection to the motor.

13-13. Tests. - Tests shall be conducted by and at the expense of the contractor to determine that the proper connections are made between the various feeders and buses in the switchboard and from the switchboard to the transformer secondaries. Tests shall also be made to determine the degree of unbalancing of the whole system.

13-14. Payment. - The contractor will be paid the contract price for Item 23 "Electric Light and Power System," for furnishing, installing, testing, and placing in operation the lighting and power system as required by the specifications and shown on the drawings.

SECTION XIV. GASOLINE-ELECTRIC STANDBY UNIT (Item 24)

14-01. Work included. - The contractor shall furnish and install one complete and fully equipped gasoline-electric generating unit in the location shown on the drawings.

14-02. General description. - a. The unit shall consist of a gasoline engine direct-connected through a flexible coupling to a synchronous type generator with direct-connected exciter, all mounted on a common cast iron or structural steel base. The generating unit shall supply 3-phase, 60-cycle alternating current power at 208/120 volts with a 4-wire circuit and shall have an output rating of 125 KVA, 80 percent power factor. A suitable exciter field rheostat shall be furnished with the generator.

b. The unit shall be equipped with a storage battery and electric starting motor, a generator, detachable hand crank, and all other necessary appurtenances for a complete installation.

c. Vibration. - The unit, complete with all accessories, shall be free from objectionable vibrations within the range of 60 r.p.m. below to 60 r.p.m. above normal speed.

d. Fuel. - The engine fuel used in all tests shall conform to Federal Specification VV-G-101a for "Gasoline; Motor, United States Government," and shall have an octane number of 60 to 70.

14-03. Gasoline engine. - a. General. - The gasoline engine for the standby unit shall be the product of a reliable manufacturer who can show at least five years' experience in the successful manufacture of engines of the type specified and for similar duty. The engine shall be of the four-cycle type with four or more cylinders and shall have a published continuous rating of not less than 150 brake horsepower at 1200 r.p.m. It shall also have a published continuous speed rating of not less than 1200 r.p.m. The maximum horsepower of the engine shall be not less than 15 percent greater than that required at full output of the generator at 1200 r.p.m.

b. Construction details. - The principal parts of the engine shall be as follows:

(1) The crankcase shall be of the pedestal base type with large side plates easily removable for inspection and adjustment of all bearings and other parts.

(2) The cylinder block shall be separate from the crankcase, and shall be cast in one piece or in pairs of cylinders. Cylinders and heads shall be fully water-jacketed.

(3) Pistons shall be of light-weight cast iron or suitable alloy, and of such construction as to provide uniform expansion of the piston skirt. Each piston shall have at least four rings, three above the piston pin and one below. Piston pins shall be made of hardened tubular steel, accurately ground and securely locked in place.

(4) The crank shaft shall be made of one piece, heat-treated alloy forging substantially designed to withstand the most severe operating conditions. It shall be dynamically and statically balanced and all journals shall be ground and polished. The crank shaft shall be drilled to provide oil feed from the pressure system to the connecting rod bearings.

(5) The camshaft shall be of high-grade, forged, heat-treated steel with integral cams.

(6) The connecting rods shall be of high-grade forged steel, properly heat-treated.

(7) Push rods shall be of hardened steel and accurately ground. Push rod guides shall be of suitable material to resist wear and heat and shall be removable.

(8) The flywheel shall be of gray iron or steel and shall be statically and dynamically balanced. It shall be constructed to withstand the maximum speed of the engine and shall be securely attached to the crank shaft on the engine side of the flexible coupling.

(9) The flexible coupling shall be of an approved type and shall be provided with a suitable guard. The coupling shall be suitable for transmitting 300 percent of the normal operating torque of the engine.

(10) The main bearings shall be of a readily removable sleeve type and shall be accurately fitted and anchored against side thrust. Oil, under pressure, shall be suitably admitted to the inside of each main bearing shell.

(11) The valves shall be of special heat-resisting steel, of large area, accurately fitted and ground to fit the valve seats. The valve seats shall be removable and of special steel, heat-treated.

(12) A positive displacement gear driven pump shall supply oil under pressure to the main bearings, connecting rod bearings, valve operating mechanism, piston pins, and timing gears. The pump shall be accessible and removable without dismantling the engine. An oil pressure gauge shall be installed on the control board. A suitable, high grade oil filter with safety by-pass valves and an oil cooler shall be provided and installed on the engine.

(13) Two carburetors equipped with chokes, air filters, flame arresters, gasoline filters, drip pans and piping shall be provided. The engine shall be equipped with two engine-driven diaphragm type gasoline pumps and a hand pump suitable for pumping the gasoline from the tank to the engine. Carburetors and gasoline piping shall conform to the requirements of the Underwriters' Laboratories. Connections to gasoline lines shall be made with flexible seamless bronze hose with woven wire protection and packless connections.

(14) Ignition and starting system. - (a) A dual ignition system shall be provided, consisting of a 12-volt battery-distributor system and an approved magneto with an impulse coupler system. There shall be two spark plugs in each cylinder, fired simultaneously. The ignition shall be so controlled that either type of ignition may be used by operating a switch. The starting push button switch of the standby unit engine shall be so designed that the current from the standby unit engine battery will not flow to aid any battery of the pump engines when their starting motors are operated. An enclosed terminal block and switch shall be installed in the standby unit engine to provide for connecting the battery charging leads from the battery chargers on the station lighting panelboard.

(b) A 12-volt, heavy-duty electric cranking motor shall be provided for starting the engine. The cranking motor shall be controlled by a 12-volt magnetic switch. The cranking motor shall be capable of cranking the engine at sufficient speed to insure starting. Suitable provision shall be made to prevent operation of the engine cranking motor except when the spark control lever is in full-retard position.

(c) A 12-volt storage battery shall be provided. The battery shall have sufficient capacity to provide 3-minute continuous cranking of the complete unit under operating conditions with an ambient engine-room temperature of 32 degrees F.

The battery shall have a special plate construction for severe or unusual conditions. Each positive plate shall be composed of multiple insulated containers filled with active materials, the containers to run vertically, horizontally or diagonally, permitting free passage of electrolyte from one face of the plate to the other; each container shall be slotted or perforated to permit diffusion of the acid electrolyte into the containers.

The electrolyte shall be of the low-gravity type with a specific gravity of 1.200 to 1.220.

The battery shall conform to the specifications for United States Government award by the Treasury Department, Procurement Division, Branch of Supply, for lead-acid storage batteries, Class 17, Item B8630.

A suitable shelf or platform with an acid-proof rubber or lead tray shall be provided on or located adjacent to the engine base for mounting the battery.

(15) A governor of the non-hunting type, similar and equal to Type UG8 as manufactured by Woodward Governor Company, shall be provided for the engine which shall provide a speed regulation within 3 percent of a normal operating speed at 1200 r.p.m. from 3/4-load to full-load. The speed variations at any one continuous load shall be not more than 1.5 percent from the normal operating speed of 1200 r.p.m. On test, the variation in speed, caused by instantaneous load changes from full-load to no-load and from 1/4-load to full-load, shall be not more than 5 percent from the normal operating speed of 1200 r.p.m.

The engine shall be provided with an automatic ignition out-out switch that will shut the engine down when the engine speed exceeds that normally controlled by the governor. The cut-out switch shall be adjustable and provided with manual reset.

(16) The exhaust manifold shall be a close-grained gray iron casting, water jacketed for its entire length, and provided with suitable flange connections having straight pipe thread for exhaust pipe. A water-cooled brass or bronze flexible exhaust shall be provided as shown on the drawings and shall be similar and equal to that manufactured by the Packless Metal Products Corporation of Long Island City, New York.

(17) An exhaust silencer for the engine shall be provided for mounting on the roof as shown on the drawings. The silencer shall be of corrosion-resistant metal and shall be similar and equal to the Model MU-2 manufactured by the Maxim Silencer Company, or the equivalent silencer manufactured by the Burgess Battery Company. A 2-inch insulation similar and equal to Keasbey and Mattison "Hy-Temp," Johns Manville "Superex" or Carey "Hi-Temp," with an 8-ounce canvas jacket shall be provided for exhaust pipe assembly insulation as shown on the drawings.

(18) A rain hood for the exhaust silencer shall be provided as indicated on the drawings. The rain hood shall be made of 16-gauge, galvanized sheet iron in accordance with Federal Specification QQ-I-696.

(19) Cooling system. - The engine shall be water-cooled with water obtained from the town water system. A temperature-regulated valve shall be installed in the cooling water intake to regulate the flow of cooling water through the engine. The regulator shall be equal to that manufactured by the Fulton Sylphon Company. There shall be provided a pressure-temperature-operated switch so arranged that it will open the ignition circuit in the event the oil pressure is not adequate for safe operation of the engine or in the event the cooling water temperature exceeds that at which the switch is set to operate. A foot-operated switch shall be provided for use when the engine is being started to cut out the oil pressure safety switch.

(20) The engine shall be ruggedly constructed for heavy duty and long life. All other details of construction not specifically mentioned shall conform with standard practice.

14-04. Miscellaneous equipment. - a. Instrument panel. - A polished metal panelboard shall be installed on the engine and the following instruments and equipment mounted thereon:

One tachometer
One main oil line pressure gauge
One ammeter
One lubricating oil filter outlet gauge
Cranking motor push-button switch
Ignition switch
Temperature gauges

b. Tools. - One set of special wrenches or tools shall be provided and mounted in a suitable cabinet.

14-05. Generator. - a. The generator shall be of the standard, rotating field, synchronous type having the rating specified in Paragraph 14-02. When the generator is operating continuously at full rated load and voltage, the temperature rise in the cores and windings shall not exceed 50 degrees Centigrade above an ambient temperature of 40 degrees Centigrade. The generator shall conform to the standards of the American Institute of Electrical Engineers and the National Electrical Manufacturers Association. It shall be a regularly manufactured type and model of a make that has been regularly manufactured for at least 5 years.

b. The stator and rotor windings shall be insulated with Class "A" insulation and shall be specially designed to resist moisture during long periods of idleness. The armature terminals shall be located as shown on the drawings, and shall be housed in a terminal box, with a removable cover, to which conduit may be readily connected from below.

c. The generator shall be provided with two sleeve bearings of ample size. The bearings shall be of phosphor bronze or bronze and babbitt-lined, and shall be positively self-lubricated by oil rings extending into an oil reservoir.

d. Slip rings shall be of bronze or brass. Brush holders shall be of rugged construction and shall be provided with an adjustable tension spring which can be adjusted while the machine is in operation and then locked in position. All ferrous materials shall be corrosion-resisting or shall be rust-proofed by a suitable process.

14-06. Exciter. - The exciter shall be mounted on an extension of the generator end bracket, and shall be direct-connected to the generator. The exciter shall be shunt wound and of sufficient capacity to afford proper excitation to the generator field coils at 150 percent of the generator rating. The terminal voltage shall be 125 volts d-c. A rheostat shall be furnished for the exciter field and shall be of the rotary type suitable for mounting on the back of the power switchboard with the controls extending through to the front of the switchboard.

14-07. Design and drawings. - a. The detailed design of the standby unit shall be such that all working parts shall be readily accessible for inspection and repair, easily duplicated, and readily replaced with each and every part of the equipment of the machine properly designed and suitable for the uses and service required.

b. Before purchasing the gasoline-electric standby unit, the contractor shall furnish drawings and specifications for the proposed standby unit for approval. The drawings shall include the engine, generator, exciter, and all accessories, with dimensions of concrete base for mounting. Accessories shall be listed on the drawings by catalog number with name of manufacturer; and shall be accompanied by cuts and the manufacturer's specification for the accessories, all properly numbered to agree with the list as shown on the drawings.

14-08. Installation. - All work shall be neatly and accurately done and shall be in accordance with the highest standards of practice for equipment of the type to be furnished. The engine and generator shall be accurately aligned on the bed-plate and securely attached thereto. Provision shall be made for lifting the engine and generator, each separately, and the entire unit completely by a crane. The unit shall be erected accurately to line and level, including the concrete base required therefor; thoroughly secured; and every detail of the work of installation shall be done in a thoroughly workmanlike manner.

14-09. Inspection and tests. - a. Shop tests. - The engine alone shall be run two hours continuously at a load corresponding to 50 percent overload of generator on dynamometer test. The combined unit shall be tested by operation at the works of the manufacturer for not less than 8 hours in the presence of an authorized representative of the contracting officer. Under this test, and for any test load specified, there shall be no evidence of serious vibration. The valve setting and governor adjustment shall be checked with the combined unit operating under various loads in the speed range specified. Immediately after the tests the contracting officer may require the engine to be opened up for inspection. A typewritten record of all shop tests, including all observations, results and graphs, shall be certified and submitted to the contracting officer, in triplicate, as soon as practicable after completion of the tests.

b. Final acceptance tests. - Final acceptance tests and trials of the gasoline-electric generator set shall be made by the contractor upon completion of the installation. The tests shall cover a period of twelve (12) continuous hours, during which period the combined engine-generator unit shall provide the normal rated output. If during the tests any imperfections of equipment, workmanship, or arrangement is found, proper correction shall be made and the entire test or any portion of it, as directed by the contracting officer, shall be repeated. In order to secure approval in these

tests, the gasoline engine shall operate smoothly, without undue noise or vibration; the governor shall maintain an even speed at all loads and the carburetors shall function without flooding and without back-firing; the electrical equipment shall operate without any indication of excessive heating and shall maintain an even voltage at all loads. Such additional tests as necessary may be required by the contracting officer. A representative of the manufacturer of the unit shall supervise the running of final acceptance tests. All final acceptance tests shall be made in the presence of an authorized representative of the contracting officer.

14-10. Painting. - Shop painting shall be in accordance with the provisions in Paragraph 18-04b. Such retouching as may appear necessary in the opinion of the contracting officer shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust-preventive compound. Field painting of all exterior parts, except brass, bronze or finished surfaces, shall be done in accordance with the provisions in Paragraph 18-04 b.

14-11. Payment. - a. Payment for furnishing and installing the gasoline-electric standby unit will be made at the contract price for Item 24, "Gasoline-Electric Standby Unit," and shall include all costs of furnishing the concrete base therefor.

b. Partial payment up to 50 percent of the contract price will be made when the equipment is delivered to the site of the work, provided the quality of such equipment is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The equipment shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

SECTION XV. TRAVELING CRANE, COMPLETE (Item 25).

15-01. Work included. - The contractor shall design, furnish and install one traveling crane, complete. The crane shall be mounted on the track in the pumping station ready for operation, in accordance with the drawings and the specifications.

15-02. General description. - The crane shall be hand operated, and shall have a working capacity of not less than 5 tons carried on one trolley. The distance from center line to center line of crane rails shall be 22 feet 4 inches. The distance from operating floor to top of crane rail shall be 15 feet 0 inches. Clearance limitations are shown on the drawings.

15-03. Detailed description. - The crane shall consist essentially of a double-I-beam or double box girder bridge mounted on two trucks, each truck having two double-flanged wheels and geared for hand-chain-operated travel, four crane stops for attachment to the crane rails, and a chain-operated traveling trolley provided with an integral, chain-operated, self-locking hoist. The crane shall be similar and equal to the "Shaw-Box," Type "BR," as manufactured by Manning, Maxwell and Moore, Inc., or to the two-speed wire rope trolley hoist double beam Figure 22 Catalogue No. 12-c as manufactured by the Wright Manufacturing Co., Division of the American Chain Company. The hoisting rope shall conform to the requirements of Federal Specification RR-R-571 for Rope, Wire, Type XXXIII, shall be thoroughly impregnated with a corrosion resistant lubricant satisfactory to the contracting officer, and shall provide for a vertical lift of not less than 35 feet. The operating chains shall provide for hand operation from the engine-room floor 15 feet below the top of the crane rail. The hoist drum shall be grooved to receive the wire rope. Provisions shall be made for proper lubrication of all moving parts. After installation the crane shall be tested for 25 percent overload.

15-04. Design. - a. The detailed design of the traveling crane shall be in accordance with the clearances indicated on the drawings and with these specifications. All working parts shall be readily accessible for inspection and repair, properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall not be greater than one-fifth of the ultimate strength of the material used.

15-05. Drawings. - In accordance with Paragraph 1-04 c, the contractor shall submit for approval detail drawings for the traveling crane he proposes to install, in sufficient detail to enable a check on the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Thickness of plates and sizes of structural shapes must be shown either on the part or in the itemized list of parts. Proposed construction shall be

clearly shown on the drawings by the liberal use of sections, enlarged details and by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications, shall be supplied by the contractor whether or not it is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the contractor shall become a part of these specifications.

15-06. Materials and workmanship. - The traveling crane shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the contractor and approved by the contracting officer and shall conform to the provisions of Section X, where applicable. All metal workmanship shall be of approved standard quality.

15-07. Installation. - The traveling crane shall be assembled and installed in the pumping station, as shown on the drawings.

15-08. Inspection and tests. - The traveling crane will be tested by the Government as soon as practicable after installation. The field tests will include complete operation of the crane throughout all its functions. Acceptance and final payment will not be made until such tests are completed to the satisfaction of the contracting officer.

15-09. Painting. - Shop painting shall be in accordance with the provisions in Paragraph 18-04. Such retouching as may appear necessary in the opinion of the contracting officer, shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventive compound. Field painting of all exterior parts, except brass, bronze or finished surfaces shall be done in accordance with the provisions in Paragraph 11-14 applying to gate hoists.

15-10. Payment. - a. Payment for designing, furnishing, installing and painting the traveling crane will be made at the contract price for Item 25, "Traveling Crane, Complete," and includes all necessary accessories not included in any other item.

b. Partial payment up to 50 percent of the contract price will be made when the traveling crane is delivered to the site of the work provided the quality of the equipment is satisfactory to the contracting officer, but in no case will the payment to the contractor exceed the cost of the equipment delivered to the site of the work. The traveling crane shall be stored and kept protected from deterioration in a manner satisfactory to the contracting officer. If any equipment so stored and partly paid for is not kept protected, no further partial payments will be made and the equipment will be protected by the contracting officer at the expense of the contractor.

SECTION XVI. MISCELLANEOUS EQUIPMENT (Items 26 to 31 incl.)

16-01. Sump pump (Item 26). - a. Description. - The contractor shall furnish and install one vertical centrifugal sump pump of the submerged type with discharge piping, as indicated on the drawings. The pump shall have a capacity of 50 gallons per minute against a total head of 40 feet. The pump shall have a cast iron casing and a bronze impeller of either the closed or open type capable of passing coarse or fibrous material. The shaft shall be of stainless steel enclosed in a wrought iron support pipe. The upper bearing shall be of the combined radial and thrust type, grease-lubricated anti-friction bearing. The lower and intermediate bearing shall be made up of a non-seizing, non-scoring high lead bronze bearing bushing with a grease reservoir. The reservoir shall be connected through suitable piping to an Alemite or Zerk fitting over the pit cover. The pump shall be bolted or welded to a small cover plate which in turn shall be bolted to the pit cover. The pump shall be driven by a 220-volt, 3-phase, 60-cycle, 1750 r.p.m vertical, squirrel-cage, drip-proof, induction motor with low starting current and normal starting torque characteristics. The motor shall be rated not less than one horsepower with a limiting temperature rise of 40 degrees Centigrade, and shall have a special moisture resisting treatment for all insulation in accordance with the N.E.M.A. Standards. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the sump pump, complete with motor starting switch and piping, which he proposes to install.

b. Payment. - The contractor will be paid the contract price for Item 26, "Sump Pump," for furnishing and installing the sump pump.

16-02. Water supply and plumbing fixtures (Item 27). - a. Work included. - (1) The contractor shall furnish and install a complete water supply and circulating system for furnishing cooling water to the gasoline engines, and other necessary fittings and plumbing fixtures. The Town of East Hartford will bring the water service to a point outside the pumping station as shown on the drawings and will install a water meter. The contractor shall connect on the Town's water service and furnish and install all pipe, valves, cocks, fittings, and plumbing fixtures as shown on the drawings and required by these specifications. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the water supply and plumbing fixtures which he proposes to install.

(2) The contractor shall furnish, and install approximately in the location shown on the drawings, an approved septic tank. The tank shall be approximately 4-1/2 feet in diameter and 5 feet deep and shall be similar and equal to Standard Series No. 65 as manufactured by the Kaustine Company, Inc., Perry, New York. The tank shall be fitted with two 6-inch connections at the top. The connections between the pumping station drain and the tank, and the effluent and the tank, shall be made with 6-inch vitrified clay pipe as shown on the drawings and will be paid for under Item 11b, "6-inch V.C. Pipe."

b. Piping and valves. - (1) All piping for the engine cooling system shall be standard weight galvanized wrought iron pipe meeting the requirements of Federal Specification WW-P-441a for Wrought Iron Pipe. Fittings shall be standard galvanized malleable iron pipe fittings. All piping and connections shall conform to local laws and regulations. Ground joint unions shall be inserted in every 30-foot run of pipe, at each piece of equipment and at such other points as required to facilitate the assembly and dismantling of the piping. The piping shall be supported at least every 10 feet on Clevis or equal hangers with 1/2-inch rods and concrete inserts. All valves shall be standard brass gate valves similar and equal to Crane No. 438 or Walworth No. 4. Funnels on the cooling water waste from the engines shall be 9 inches in diameter and 9 inches high, made of 16-ounce copper, and shall have a beaded top. The water supply connection to each engine shall be made with a short section of brass or bronze flexible metal hose similar and equal to that manufactured by the Chicago Metal Hose Corporation or the Packless Metal Products Corporation.

(2) Water supply pipe shall be standard I.P.S. brass pipe conforming to Federal Specification WW-P-351 for Brass Pipe. Pipe fittings shall conform to Federal Specification WW-P-448 for 125-pound Brass or Bronze Pipe-Fittings. Valves shall be standard brass gate valves similar and equal to Crane No. 438. Hose cocks shall be 3/4-inch finished brass tee-handle faucets similar and equal to Crane No. C31103. Piping shall be supported at least every ten feet with Clevis or equal hangers with 1/2-inch rods and concrete inserts.

c. Plumbing fixtures. - The plumbing fixtures shall conform to the requirements of Federal Specification WW-P-541 for Plumbing Fixtures. The lavatory shall meet the requirements for Outfit No. IB21, Cast Iron enameled, 21-inch, wall-hung. It shall be furnished complete with one compression faucet, 1-1/2-inch P trap, chain-stay, chain, and stopper. The water closet shall meet the requirements for Outfit No. E46F vitreous china water closet, siphon jet elongated bowl, with flushing valve. All exposed supply and drain piping at the fixtures shall be chromium-plated brass tubing and all handles and escutcheons shall be chromium-plated brass.

d. Payment. - The contractor will be paid the contract price for Item 27, "Water Supply and Plumbing Fixtures" for furnishing and installing the water supply piping and plumbing fixtures in accordance with the specifications and drawings.

16-03. Carbon dioxide fire extinguishing equipment. - (Item 28). - a. Work included. - The contractor shall furnish and install a complete manually operated carbon dioxide fire extinguishing system for the protection of the three gasoline engines driving the pumps and the gasoline-electric generating unit. The system shall be installed as indicated on the drawings and shall consist essentially of the following equipment:

4-50-pound capacity cylinders of carbon dioxide
1 - Steel angle frame assembly with wire mesh enclosure
5 - 1/2-inch manually operated directional valves with cast bronze name plates
2 - Manually operated remote control stations
1 - 3/4-inch pipe header
1 - Set 1/2-inch branch piping to each engine
1 - Spare parts kit and operating instructions

In addition to the above, there shall be furnished two portable, 15-pound, carbon dioxide extinguishers, each with 3 feet of hose, and a permanent shut-off of the seat type. Each portable extinguisher shall be mounted on a wall bracket at the location shown on the drawings. The equipment shall be similar and equal to that manufactured by Walter Kidde and Company or the C-O-Two Equipment Company. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the carbon dioxide fire extinguishing equipment he proposes to install. The contractor shall also furnish the necessary test cylinders for testing the system.

b. Cylinder battery. - The cylinder battery shall consist of a bank of four 50-pound capacity carbon dioxide cylinders assembled in a framework and arranged so they can be weighed without removing them from the framework and without putting the system out of service. The cylinders shall stand in their normal upright position and shall be properly guarded with removable wire mesh screening.

Each cylinder shall be equipped with a cylinder valve having a 1" I.P.S. American Standard tapered thread screwing into the cylinder. A Syphon tube having a clear hole diameter of 7/16" ± 1/64" shall extend from valve approximately to the base of the cylinder so that liquid carbon dioxide is taken from the cylinder. The cylinder valve is to be made of forged brass and shall be sufficiently strong to withstand a test pressure of 3,000 pounds per square inch without distortion. Each valve shall be equipped with a safety disc made of rolled gold on a copper metal base, for the purpose of releasing the gas in the cylinder at excessive temperatures.

To each cylinder valve shall be attached a cutter valve housing a hollow tubular cutter, the advance of which serves to cut a clean hole through the safety disc so as to permit the carbon dioxide to discharge. Advance of the cutter shall be caused by the rotation of a lever approximately 6-1/2" long. The maximum force necessary to effect rotation of this lever shall be 15 pounds per cylinder.

The outlet of each cutter valve shall be connected by means of a flexible metal loop to a common manifold. The connecting tee at the manifold shall have as an integral part a check valve to prevent loss of gas in the event that one or more cylinders are disconnected from the manifold at a time when gas is discharged. The arrangement must be such that premature discharge of the gas in one cylinder shall not cause the discharge of gas in the other cylinder.

c. Piping system. - A suitable piping system shall be provided to convey the carbon dioxide from the cylinder battery to the space protected. The gas shall be discharged through suitable shielded type outlets, specially designed to discharge the gas in such a manner as to eliminate turbulence, prevent the entrainment of air, and produce the maximum amount of carbon dioxide snow without possibility of freeze-up. All pipe and fittings leading from the directional valves to the engines shall be hot-dipped, galvanized and scale-free. All tees, elbows, crosses, and other fittings must be galvanized and have a minimum bursting pressure of 6,000 pounds per square inch. Distribution piping and its support at each engine shall be standard brass pipe. All fitting shall be extra heavy cast bronze fittings have a bursting pressure not less than 6,000 pounds per square inch.

The system shall be so arranged that two carbon dioxide cylinders are connected and ready for use at all times and the other two are connected for reserve use in the event the contents of the first two cylinders are exhausted. Two break glass pull boxes shall be provided and mounted as shown on the drawings, each pull box controlling two cylinders. Each pull box shall consist of a pull handle which is connected through suitable corrosion-resisting cable to the releasing device at the cylinders. The cable is to be run in 3/8-inch I.P.S. conduit and enclosed corner pulleys shall be employed at all right-angle bends. The entire system shall be installed in accordance with the recommendation of the manufacturer.

d. Payment.- The contractor will be paid the contract price for Item 28 "Carbon Dioxide Fire Extinguishing Equipment" for furnishing and installing the carbon dioxide fire extinguishing equipment as required by the specifications and the drawings.

16-04. Drains (Item 29). - a. Work included. - The contractor shall furnish and install all waste, drain and vent piping. The work shall include the waste lines from the plumbing fixtures, the exhaust pipe draw-off, and other drain and waste piping shown on the drawings, but shall not include the waste cooling water lines from the engines which form a part of the engine cooling water system and are included under Item 27. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the waste, drain and vent piping he proposes to install.

b. Piping. - Drain, waste, and vent piping shall, in general, be standard weight galvanized wrought iron pipe conforming to Federal Specification WW-P-441a for Wrought Iron Pipe. Fittings shall be standard screwed galvanized cast iron drainage fittings. Where soil pipe is called for it shall be cast iron, bell-and-spigot soil pipe conforming to Federal Specification WW-P-401 for Cast Iron Soil Pipe and Fittings. Cast iron pipe shall be laid with the bell end pointing in the opposite direction to the flow of the waste water. The joints shall be made tight with pure oakum caulked into the bell of the pipe until one-third full, and the remaining two-thirds of the bell shall be poured full of molten pig lead and caulked flush with

the hub. Vent lines extending through the roof shall be flashed with 16-ounce copper brought up and turned down into the pipe. Vents shall extend at least 18 inches above the roof.

c. Payment.- The contractor will be paid the contract price for Item 29, "Drains," for furnishing and installing drains, vents, and waste lines as required by the specifications and shown on the drawings.

16-05. Gasoline tank and piping (Item 30). - a. The contractor shall furnish and install one gasoline storage tank together with fill and vent pipes, gasoline gage, and supply and drain piping to the gasoline engines and gasoline-electric standby unit as shown on the drawings. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the gasoline tank, piping and gage which he proposes to install.

b. The gasoline tank shall be of welded steel construction, and shall comply with the legal requirements of the Town of East Hartford, Conn.

c. All piping outside the pumping station shall be wrought iron pipe conforming to Federal Specification WW-P-441a. Fittings shall be malleable iron screwed fittings conforming to Federal Specification WW-P-521. All gasoline piping inside the pumping station shall be copper tubing conforming to Federal Specification WW-T-799, Type K, installed with flared fittings. The foot valves on the suction lines inside the gasoline tank shall be of the Single Poppet type similar and equal to Amco Figure 438. The vent pipes shall be securely clamped to the building wall.

d. The gasoline gage shall be installed on the wall of the engine room as shown on the drawings. It shall be capable of indicating the amount of gasoline in the storage tank and shall be of the automatic remote-reading type similar and equal to that manufactured by the Liquidometer Corporation of Long Island City, New York. It shall be float-operated, the motion of the float operating against sylphons of a closed hydraulic system, and the system shall be filled with a liquid for the purpose of transmitting the motion of the float to the indicator sylphons. The indicator shall be installed in a protecting case not less than 12 inches by 12 inches and provided with a scale graduated to 3200 gallons. The flexible hydraulic tubing shall be protected by a metallic armor for connecting the indicator with the float mechanism. The connection between the gasoline tank and gage line shall be protected by a structural steel box of suitable size.

e. Payment. - The contractor will be paid the contract price for Item 30, "Gasoline Tank and Piping," for furnishing and installing the gasoline tank, gage, and piping in accordance with the drawings and specifications.

16-06. Float gage (Item 31). - a. Description. - The contractor shall furnish and install an indicating dial type float gage. The float gage well shall be of 6-inch, standard weight, genuine wrought iron pipe installed at the location and in the manner shown on the drawings. The float, tape, and counterweight shall be made of corrosion-resisting metal. The dial shall be 12 inches in diameter and graduated from 0 to 20 feet in tenths of a foot. The protection grille for the tape shall be baked enamel wire-mesh of 1/8-inch wire, with 1-1/2-inch diamond shaped mesh complete with ferrule for attaching the grille to the pumping station wall. The equipment shall be similar and equal to the No. 639 Dial Indicator manufactured by the W. and L. E. Gurley Company of Troy, New York. In accordance with the provisions of Paragraph 1-04 c, the contractor shall submit for approval detailed drawings and data descriptive of the float gage and accessories which he proposes to install.

b. Payment. - The contractor will be paid the contract price for Item 31, "Float Gage," for furnishing and installing the float gage and well in accordance with the specifications and drawings.

SECTION XVII. INSTALLATION AND TESTING OF EQUIPMENT.

17-01. Work included. - a. The contractor shall install all of the equipment furnished by him under the contract, and shall also install, under Item 32, the following equipment to be furnished by the Government:

(1) Four 30-inch pumps.
(2) One 20-inch pump with electric motor.
(3) Four gasoline engines with silencers and exhaust piping.
(4) Four right angle gear units.
(5) Intake and discharge piping and valves for all pumps.

b. The equipment to be furnished by the Government shall be installed under the supervision of a representative of the manufacturer. This supervision will be paid for by the Government.

17-02. Delivery. - a. The embedded items and anchor bolts for all equipment to be furnished by the Government will be available as follows: Anchor bolts approximately 30 days after notice to proceed and other embedded items approximately 100 days after notice to proceed; and the remainder of the equipment approximately 150 days after notice to proceed. The contractor shall notify the contracting officer of the desired date of delivery (see Paragraph 1-14).

b. The contractor shall promptly unload the materials and equipment from railroad cars and trucks, and will be held responsible for any demurrage charges incurred due to failure to unload promptly the cars or trucks. The contractor shall transport the materials and equipment from the point of delivery to the site of the work and shall store them in a suitable warehouse until they are incorporated in the work. The cost of unloading, handling, hauling, storage, and caring for materials and equipment furnished by the Government shall be included in the contract price of Item 32.

c. The contractor shall check the quantity and condition of all materials and equipment when delivered to him and in case there is any damage to, or shortage of, material or equipment, he shall so report to the contracting officer, in writing, within 24 hours.

17-03. Packing and shipping. - All of the equipment that is to be furnished by the contractor and installed under the contract shall be adequately protected during shipment and shall be brought to the site of the work in good condition, free from damage, corrosion, or other defects. The apparatus shall be boxed, crated, or otherwise protected so as to prevent damage during shipment. Before shipment, all the apparatus shall be thoroughly cleaned, unfinished iron and steel surfaces shall be painted as required in Section XVIII and all finished surfaces that might be subject to rust or corrosion prior to assembly shall be coated with a suitable, easily removable, rust-preventing compound (see Paragraph 1-13).

17-04. Installation. - The contractor shall install, erect, attach

or build into the structures all the machinery, piping, and other metal work in a workmanlike manner as shown on the drawings or directed by the contracting officer. Wherever possible all parts shall be made accurately to standard gauge to facilitate replacement and repair. All work of the installation of the equipment shall follow the best modern practice in the installation of machine ry of this type, notwithstanding any omission from these specifications. All work of installation shall be done by mechanics skilled in their various trades. The equipment shall be anchored to concrete foundations by means of steel anchor bolts. The anchor bolts shall be set at the time of placing the concrete foundations as shown on the drawings. The concrete foundations for the e quipment shall be constructed to the dimensions shown on the drawings or as recommended by the equipment manufacturer and shall be securely attached to the structural concrete floor slab by means of steel dowels. The equipment shall be given a touch-up coat of paint as required before the finish painting is done (see Section XVIII).

17-05. Pumps, gear units, discharge piping, valves and accessories. - Four 30-inch propeller pumps and one 20-inch volute type pump complete electric motor discharge piping, valves, gear units, anchor bolts and accessories shall be installed in the pumping station at the locations as shown on the drawings. The complete pumping units shall be set accurately plumb and anchored to the concrete floor slab by means of anchor bolts. The contractor will be permitted to grout in the wall section of each pump after the pump is assembled. The anchor bolts shall be set at the time the concrete is placed. The gate valves and horizontal piping will be supported by suspension hangers as shown on the drawings. All discharge piping shall be securely anchored as shown on the drawings, at the section extending through the pumping station wall.

17-06. Gasoline engines. - Four gasoline engines with silencers and exhaust piping, anchor bolts and accessories shall be installed in the pumping station at the locations shown on the drawings. The contractor shall furnish and install a 2-inch insulation similar and equal to Keasbey and Mattison "Hy-Temp," Johns Manville "Superex" or Carey "Hi-Temp," with an 8-ounce canvasjacket for exhaust pipe assembly insulation as shown on the drawings. The gasoline engines shall be set accurately and anchored to the floor slab by means of anchor bolts. The anchor bolts shall be set at the time the concrete is placed.

17-07. Pipe fitting. - a. All pipe connections and joints shall be made tight and shall conform to local laws and regulations. Pipe threads shall be coated with Crane thread lubricant or equal so as to insure a tight joint. Sleeves for all pipes through floors and walls shall be extra strong, black wrought iron pipe conforming to Federal Specification WW-P-441a for Wrought Iron Pipe. A lead joint shall be caulked between the pipe and the sleeve to form a watertight joint as shown on the drawings. Before any piping is covered up it shall be tested for leaks and made tight. The steam and water piping shall be

tested by filling the systems with water and holding them for two hours under a pressure of 50 pounds per square inch for the steam piping and 150 pounds per square inch for the water piping. All piping tests shall be conducted as directed by the contracting officer and in the presence of his authorized representative.

b. In all runs of screwed piping, ground joint unions shall be inserted in every 30-foot run of pipe, at each item of equipment, and at such other places as is required to facilitate assembling and disassembling the piping.

17-08. Operation of equipment. - a. Equipment furnished by the contractor. - (1) After installation, all of the equipment and apparatus furnished and installed under the contract shall be placed in operation by the contractor and operated for a sufficient length of time and in such a manner as to satisfy the contracting officer that the equipment has been properly installed and that it meets all of the other requirements of the specifications. The contractor shall also perform such field tests as are required by the specifications and as may be directed by the contracting officer, relating to the following equipment: Sluice gates, complete with hoists (see Paragraph 11-13). Heating and ventilating equipment (see Paragraph 12-08). Electric light and power system (see Section XIII). Gasoline-electric standby unit (see Paragraph 14-09). Traveling crane (see Paragraph 15-08). Miscellaneous equipment (see Section XVI).

(2) In the event the operation or testing of the equipment by the contractor discloses any defects or failure to comply with the specifications, the equipment shall be immediately shut down and said defect or failure shall be corrected by the contractor to the satisfaction of the contracting officer, and the equipment shall again be placed in operation (see Paragraph 1-37, 17-10 b and 17-11a).

b. Equipment furnished by the Government. - After installation, all of the equipment furnished by the Government (see Paragraph 17-01 a), and installed under the contract shall be placed in operation by the contractor and operated for a sufficient length of time and in such a manner as to satisfy the contracting officer that the equipment has been properly installed. In the even the operation of the equipment by the contractor discloses any defect due to faulty or improper installation, the equipment shall be immediately shut down and said defect shall be corrected by the contractor to the satisfaction of the contracting officer. All field tests of this equipment will be conducted by the Government (see Paragraphs 1-37, 17-10 and 17-11 b).

17-09. Fuel and lubricants. - All fuel, electric energy, and lubricants necessary to place the equipment furnished under these specifications in operation and to perform the required field tests shall be furnished by the contractor. All oil reservoirs and grease containers shall be filled to their proper operating level. All fuel,

lubricants, and other materials furnished by the contractor shall be those recommended by the manufacturer of the equipment in which it is to be used and shall meet the approval of the contracting officer. The Government will furnish all fuels and lubricants necessary to place in operation the equipment furnished by the Government.

17-10. Tests. - a. Installation. - Special care shall be exercised when aligning gear unit, electric motor and pump shafts to insure free running in the bearings without binding. The shafts shall be turned by hand for at least 50 complete revolutions of the pump impeller. After the pump unit is completely installed it shall be given a thorough check for alignment and anchorage. The gate valves shall be opened and closed to insure free travel from the fully closed to the fully open positions. The check valve shall be swung open and shut without causing any undue binding.

b. Final operations. - After complete installation of pumping station equipment the contractor shall operate the equipment for sufficient duration to ascertain that all equipment is in good running condition. Any changes or adjustments necessary to secure satisfactory operation shall be made by and at the expense of the contractor. Provided that if any part of the equipment is found to be defective due to no fault of the contractor as determined by the contracting officer, the contracting officer may order the contractor to correct such defects and payments therefor will be made to the contractor under the provisions of Article 3 of the contract.

17-11. Payment. - a. Equipment furnished by the contractor. - Payment for installing and testing the equipment and apparatus furnished by the contractor shall be included in the applicable contract prices. (see Sections XI to XVI incl.)

b. Equipment furnished by the Government. - Payment for installing the equipment furnished by the Government (see Paragraphs 1-14 and 17-01 a) will be made at the contract price for Item 32 "Installing Equipment Furnished by the Government" and shall include the cost of unloading and hauling from the point of delivery, storing, handling, erecting, cleaning, placing, painting, testing and maintaining said equipment until final acceptance of the work by the contracting officer, and for furnishing and installing gasoline engine exhaust pipe insulation as specified.

SECTION XVIII. PAINTING

18-01. Work included. - The contractor shall do all shop and field painting of equipment, and all other painting required at the pumping station, except that shop painting of equipment furnished by the Government as provided in Par. 1-14 will be done by others. All exposed iron and steel work not galvanized, all unfinished iron or steel parts of the equipment, all doors, door frames, and louvers, and the finished concrete surfaces of the engine-room floor and side walls shall be painted.

18-02. Paint materials. - a. All paint and paint materials shall conform, where applicable, to Federal Specifications of Group TT.

b. Priming coats for metal work shall be pure red lead paint, except that priming coats for standard manufactured articles and equipment may conform to the manufacturer's standard practice when approved by the contracting officer. Red lead paint shall be mixed in approximately the following proportions.

Paste red lead	100 lbs.
Raw linseed oil	1-7/8 gals.
Turpentine	2-1/2 pints (max.)
Drier	2-1/2 pints (max.)

c. Except as otherwise provided, finish painting above the engine-room floor shall be done with pure lead and oil paint of a composition and color as specified herein or approved by the contracting officer. With the exception of color pigments, the only pigments used in the paint shall be lead carbonate, zinc oxide, and titanium dioxide. No lithopone or fillers shall be used in the paint. Samples of all paint shall be submitted to the contracting officer for approval and selection.

18-03. Painting steel. - a. All ungalvanized structural and miscellaneous steel work not to be encased in concrete shall be given one shop coat and one field coat of red lead paint. After the shop fabrication has been completed and accepted, all material shall be cleaned of rust, loose scale, dirt, oil, grease, and other foreign substances, by wiping with gasoline or benzene, or by other approved means. After cleaning, the steel shall be given one shop coat of red lead paint. Surfaces which will not be accessible after assembly, but not in contact in riveted connections, shall be given a second shop coat.

b. After erection the steel shall be touched up by painting over all spots where the shop coat has been scratched, knocked off, or otherwise damaged. After touching up, the steel shall then be given a field coat of red lead paint. Either the shop coat or field coat shall contain a small amount of lamp black so that the field coat may be readily differentiated from the shop coat.

c. Steel above the engine-room floor shall be given one finish coat of approved paint (see Par. 18-02 c). Finish painting of steel below the engine-room floor shall be of one coat of an asphalt paint similar and equal to "Anchor" asphalt paint manufactured by the Barrett Company of New York, and shall meet the requirements of Federal Specification TT-V-51, Type B, for Asphalt Varnish.

18-04. Painting equipment. - a. The equipment furnished by the Government will be painted by the equipment manufacturer. After installation, the contractor shall touch up all painted surfaces of equipment below the engine-room floor as found necessary by the contracting officer with the same type and color of paint as originally used by the manufacturer. Equipment above the engine-room floor shall be given one coat of approved paint (see Par. 18-02c).

b. All unfinished iron and steel parts of the equipment furnished by the contractor shall be given one shop priming coat, one field touch-up priming coat, and two finish coats of approved paint (see Par. 18-02 c). The sluice gate and hoist shall be painted in accordance with the requirements of Par. 11-14.

18-05. Painting pipe. - All exposed, ungalvanized iron and steel pipe, valves, and fittings shall be given one shop priming coat, one field priming coat, and two finish coats of approved paint. The piping for the fire extinguisher equipment and circulating water system shall be painted with suitable identifying bands, as directed by the contracting officer and in accordance with local laws and regulations. Cast iron pipe and other pipe below the engine-room floor shall be finished with black asphalt paint as specified in Par. 18-03 c. Unless otherwise directed by the contracting officer, pipe insulation shall be sized and painted with two coats of an approved lead and oil paint.

18-06. Painting tanks and trash racks. - a. Those portions of the trash racks that are not encased in concrete shall be thoroughly cleaned and given one coat of red lead paint after installation. The finish painting shall consist of two coats of black graphite paint as specified in Par. 11-14 for sluice gates.

b. The gasoline and oil tanks shall be painted in the shop with one coat of red lead paint and two coats of black graphite paint as specified in Par. 11-14 for sluice gates. After installation any spots on the tanks where the paint has been damaged shall be touched up with graphite paint.

18-07. Painting concrete. - The concrete floor of the engine-room, the concrete machinery bases, and the walls below the brick masonry shall be painted with two coats of an approved lead and oil paint. Before painting, the concrete shall be thoroughly cleaned of all dirt, oil, grease, and other foreign material by scrubbing with soapsuds and flushing with clean, warm water. After washing, the concrete shall be treated with a weak solution of muriatic acid and again flushed with clean water. The concrete shall then be allowed

to become thoroughly dry before painting. No paint shall be applied to concrete for at least 30 days after the concrete is placed.

18-08. Application of paint. - Paint may be applied by either brushing or spraying, provided satisfactory results are obtained. No paint shall be applied on damp or frosted surfaces and material painted under cover in damp or cold weather shall remain under cover until dry. Painting shall be done in a neat and workmanlike manner and all joints and crevices shall be thoroughly coated.

18-09. Payment. - No direct payment will be made to the contractor for painting, but all compensation desired therefor shall be included in the contract prices for the several contract items involved.

SECTION XIX. MISCELLANEOUS (Items 33 to 38 incl.)

19-01. Seeding (Item 33). - a. Work included. - (1) The contractor shall do all seeding where shown on the drawings or directed by the contracting officer.

(2) Unless otherwise directed by the contracting officer, seeding shall be completed by September 15th of the current construction season, and any portion of the seeding operations not completed shall be deferred until the following spring season. The contractor shall be responsible for proper maintenance of the areas seeded until the entire work is completed and accepted.

b. Seeding. - (1) Preparation. - Before seeding, the areas to be seeded shall be fertilized with any approved commercial 7-7-7 lawn fertilizer at the quantity of 1000 pounds per acre and well worked into the soil. All grass or cover crop seed shall be sown when directed by the contracting officer, so as to secure the greatest possible protection against erosion. The finished surface grade of the slopes shall be maintained in a true and even condition during the seed-sowing operation, and the contractor shall rake the soil to a depth of three-quarters of an inch (3/4") by using iron rakes immediately previous to sowing seed. All raking shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill. All sticks, stones, weeds or trash appearing on the surface shall be removed.

(2) Seed Mixture. - The following mixture will be approved for each acre of seeding:

Perennial Rye Grass	7 lbs.
Orchard Grass	15 lbs.
Hard Fescue	4 lbs.
Kentucky Blue	6 lbs.
Sheep Fescue	6 lbs.
Timothy	7 lbs.
Perennial Red Clover	4 lbs.
White Clover	4 lbs.
Red Top	7 lbs.
Total per acre	60 lbs.

For all seeded areas, about 15 pounds of oats per acre shall be added if the planting is done between the middle of June and the middle of September.

(3) Method of seeding. - The contractor shall take advantage of favorable weather and shall employ a method of sowing satisfactory to the contracting officer. The seed shall be raked in and the whole surface then lightly rolled. Seeding shall be done immediately after the preparation of the earth surface unless otherwise directed. If there be any delay, and if weeds grow in and with the grass,

such weeds shall be cut out before they go to seed or at such time as directed by the contracting officer. If any loam is washed away or any portions of the sodded areas are not covered by grass, the contractor shall replace the topsoil, fertilize and re-seed.

(4) Maintenance. - The contractor shall maintain the areas sown to grass seed on each section of the project, until all work on the entire contract has been completed and accepted by the contracting officer. This maintainenance shall consist of occastional mowing with a scythe or mechanical mower, watering during periods of drought, and removal of conspicuous weeds, or any other similar operations whenever required by the contracting officer. The turf areas shall be fertilized with an acceptable commercial lawn fertilizer of a quality equal to Vigoro or Scott's lawn fertilizer at the customary quantity per acre recommended by the manufacturer.

c. Measurement and payment. - The quantity to be paid for under Item 33 will be the number of acres seeded as directed. The measurement will be the actual superficial areas seeded. Payment shall include all costs of seeding as specified in subparagraph b above, and for all materials and expenses thereto. Payment will be made at the contract unit price for Item 33, "Seeding."

19-08. Highway guard posts (Item 36). - a. Work included. - The contractor shall furnish and install highway guard posts in the locations as shown on the drawings or as directed by the contracting officer.

b. Materials. - The posts shall be of straight, sound, seasoned white oak, cedar, pitch pine, tamarack or locust. The posts shall be at least 6 inches in diameter at the small end with the bark removed. They shall be of the length indicated on the drawings and the bottoms shall be sawed off square. The bark shall be removed. Knots shall be hewn flush and smooth with the face. The posts shall be treated with a standard wood preservative of a creosote coal tar solution. This preservative shall be applied to the posts according to current standard specifications of the Connecticut State Highway Department, substantially as follows: All guard rail posts shall be given a preservative treatment from the bottom to 6 inches above the ground line as follows: Posts to be treated must be seasoned air dry. Special care shall be exercised to see that the portion treated is free from all inner and outer bark. Posts shall be immersed to a point 6 inches above the ground line in:

(1) Hot bath of preservative material maintained at a temperature of approximately 200 degrees F. for one hour.

(2) Immediately after (1), transfer to cold bath of preservative material to be maintained at atmospheric temperature within the minimum and maximum limits of 50 degrees F. and 100 degrees F. wherein posts are likewise to be immersed for one hour.

The preservative material shall be a liquid grade of pure coal-tar creosote oil, specially refined for non-pressure treatments and conforming to approved standard requirements.

c. Construction methods. - The posts shall be securely set as shown on the drawings or as directed by the contracting officer. The posts shall be spaced as shown on the drawings; backfillings shall be thoroughly tamped into place. Top ends of the posts shall be beveled according to the standard practice of the Connecticut State Highway Department. Painting and finishing of the posts shall be done according to the standard practice of the Connecticut State Highway Department for "Cable Railing, Wood Posts," substantially as follows: After satisfactory erection the posts, when dry, shall be painted in an approved manner with two coats of the specified material. No painting will be allowed when the air temperature is 40 degrees F. or below. After the first coat of paint has been applied, at least 3 days shall elapse before the application of the second coat of paint. Black paint shall be used for painting the guard rail posts from the ground line up 16 inches. The paint shall be homogeneous, free from water, and shall dry hard in 20 hours with a jet black color, and shall conform to approved standard requirements. White paint shall be used for painting the guard rail posts from a point 16 inches above the ground to the top. The paint shall be composed of suitable pigment mixed with pure, raw linseed oil and approved drier, free from rosin, to cause the applied paint to dry in approximately 3 days.

d. Payment. - The contract price for Item 36, "Highway Guard Posts," shall include all materials, tools, labor and work for furnishing and placing highway guard posts, including all excavation, backfill and disposal of surplus materials.

19-03. Timber stop-logs (Item 37). - a. Work included. - Creosoted timber stop-logs shall be furnished and installed for the inlet and outlet structures at the locations shown on the drawings or as directed by the contracting officer.

b. Materials. - Creosoted timber shall be No. 1 Common plain white oak conforming with the Standard Grading and Dressing Rules of the National Hardwood Lumber Association and to Federal Specification MM-L-736, "Lumber and Timber; Hardwood." Timber shall be treated with a creosote-coal-tar-solution conforming to Federal Specification TT-W-566, "Wood-Preservative; Creosote-Coal-Tar-Solution (for) Ties and Structural-Timbers." (See Specification No. 5-b of the American Wood Preservers' Association.) Timber shall be treated by the pressure process in accordance with Federal Specification TT-W -571a, "Wood-Preservative; Preservative-Treatment." The minimum absorption of preservative shall be 6 pounds per cubic foot by the empty cell treatment (see Specification for treatment, American Wood Preservers' Association Specification No. 3-b).

c. Description. - Stop-logs with their necessary bracing shall be carefully framed to fit the inlet and outlet structures, and shall be installed as shown on the drawings and removed and stored as directed by the contracting officer. Creosoting shall be done after the stop-logs have been cut to length and surfaced.

d. Measurement and payment. - Measurement for payment will be based on the number of thousand feet board measure furnished and installed, and will be in accordance with the standard grading rules of the National Hardwood Lumber Association. Payment will be made at the contract unit price for Item 37, "Timber Stop-Logs," and shall include all costs of furnishing and installing, and removing and storing timber stop-logs in a designated place.

19-04. Timber sheeting (Item 38). - a. Work included. - The contractor shall furnish and install the permanent timber sheeting required at the pumping station structure at the locations shown on the drawings or as directed by the contracting officer, including all necessary wales, braces and miscellaneous hardware. Except for the removal of such bracing as may be approved by the contracting officer, the timber sheeting installed shall be left in place.

b. Material. - The sheeting shall be of the dimensions shown on the drawings. Timber for wales and braces not shown on the drawings shall be of economical dimensions, acceptable in modern practice, and as approved by the contracting officer. All timber used shall be sound and of good quality, and shall meet the approval of the contracting officer. Bolts and other hardware shall conform to current standard practice for the material required and use intended.

c. Installation. - The sheeting shall be driven true to line and grade so as not to encroach on the neat-line of the structure as shown on the drawings, without injury to the sheeting, and shall be cut off, where necessary, to the top elevation as shown on the drawings. Necessary wales and bracing shall be installed as shown on the drawings or as directed by the contracting officer.

d. Measurement and payment. - The quantity to be paid for will be the number of square feet of timber sheeting actually in place as specified between the top and bottom elevations shown on the drawings or elsewhere as directed. Payment will be made at the contract unit price for Item 38, "Timber Sheeting."

19-05. Cleaning up. - a. Work included. - The contractor shall remove all construction equipment and all temporary structures built or used by him, shall remove rubbish of all kinds from the site of the work, and from any grounds which he shall have occupied within the limits of the work, and shall leave the site of the work in a clean condition satisfactory to the contracting officer. All materials salvaged shall be the property of the contractor.

b. Payment. - For all work, materials and incidentals required to clean up as set forth in a above, the contractor will receive no direct payment, but payment shall be considered as having been included in the contract prices for Items 1 to 38, inclusive.

U. S. Engineer Office
Providence, R. I.
July 28, 1941.

Invitation No. 699-42-24

STANDARD GOVERNMENT FORM OF BID
(Construction Contract)

The District Engineer
U. S. Engineer Office
Room 819, Industrial Trust Bldg.
Providence, Rhode Island

Place _____

Date _____

In compliance with your invitation for bids dated July 28, 1941, and subject to all the conditions thereof, the undersigned,

_____

a corporation organized and existing under the laws of the State of _____, a partnership consisting of _____

_____

_____

_____

_____

or an individual trading as _____

_____

_____

of the City of _____ hereby proposes to furnish all plant, labor, and materials, except the equipment and materials specified in Paragraphs 1-14, 7-19, 9-15 b and Section XVII of the specifications, and perform all work required for the construction of the Meadow Hill Pumping Station and appurtenant structures on the Connecticut River at East Hartford, Connecticut, including all work indicated on the drawings, or required by the specifications, and such incidental work as needed or ordered in writing by the contracting officer, in strict accordance with the specifications, schedules, and drawings, for the consideration of the following prices:

Item	Designation	Unit	Quantity	Unit Price	Amount
1	Preparation of Site	job	-		
2	Unwatering Construction Area	"	-		
3	Common Excavation - General	cu.yd.	5,600		
4	Common Excavation - Trench	" "	100		
5	Common Excavation - Borrow Areas	" "	1,800		
6	Gravel Bedding	" "	50		
7	Compacted Impervious Backfill	" "	2,000		
8	Semi-Compacted Fill	" "	5,500		
9	Riprap - Hand Placed	" "	80		
10	Deleted				
11	V.C. Pipe				
	a. 4-Inch	lin.ft.	75		
	b. 6-Inch	" "	95		
	c. 30-Inch	" "	45		
12	Cement	bbl.	1,700		
13	Concrete - Class "A"	cu.yd.	1,160		
14	Concrete - Class "B"	" "	240		
15	Steel Reinforcement	lb.	196,000		
16	Pumping Station Superstructure	job	-		
17	Miscellaneous Iron and Steel	lb.	14,800		
18	Miscellaneous Pipe and Fittings	"	2,800		
19	Structural Steel for Service Bridge	"	8,200		
20	Steel Trash Racks	job	-		
21	Sluice Gates, Complete with Hoists	"	-		
22	Heating and Ventilating Equipment	"	-		
23	Electric Light and Power System	"	-		
24	Gasoline Electric Standby Unit	"	-		
25	Traveling Crane, Complete	"	-		
26	Sump Pump	"	-		
27	Water Supply and Plumbing Fixtures	"	-		
28	Carbon Dioxide Fire Extinguishing Equipment	"	-		
29	Drains	"	-		
30	Gasoline Tank and Piping	"	-		
31	Float Gage	"	-		
32	Installing Equipment Furnished by the Government	"	-		
33	Seeding	acre	0.5		
34	Deleted				
35	Deleted				
36	Highway Guard Posts	job	-		
37	Timber Stop-Logs	MFBM	1.02		
38	Timber Sheeting	sq.ft.	275		
	TOTAL				

Note:- All amounts and total given above will be subject to verification by the Government. In case of variation between unit bid price and totals shown by bidder, the unit price will be considered to be his bid.

PLANT TO BE USED

(See Invitation for Bids and Paragraph 1-09 of the specifications.)

Note;- Use separate line for each major item.

No.	Name	Kind	Capacity	Age and Condition
		Material Handling Equipment		
		Pumping Equipment (Construction)		
		Excavating Equipment		
		Concreting Equipment		
		Miscellaneous Equipment		

EXPERIENCE. - (See Invitation for Bids)

D A T A S H E E T S

The bidder shall submit with his proposal the following information regarding the equipment he proposes to furnish. Statements so made by the bidder are intended to be, and are, express warranties. Award of this contract shall not be construed as a guarantee by the Government that the materials or supplies listed in the Bid Form are approved.

DATA SHEET

SLUICE GATES

1. Gates:

   Manufacturer _____

2. Hoists:

   a. Manufacturer's name _____

   b. Model or type _____

   c. Hoisting speed _____

3. Electric Motors:

   a. Manufacturer's name _____

   b. Type and rating _____

DATA SHEET

ELECTRIC SWITCHBOARD

Manufacturer _____

Type Construction _____

Overall Dimensions _____

DATA SHEET

125 KVA GASOLINE-ELECTRIC GENERATOR UNIT

1. Engine (Manufacturer): _____

Number Cylinders: _____

Bore and Stroke: _____

Piston Speed at Rated Output: _____

Lbs. Fuel per kw.-hr. at 100% Rated Output of Generator: _____

Lbs. Fuel per kw.-hr. at 75% Rated Output of Generator: _____

Battery (Make and Type): _____

Governor (Make and Type): _____

Net Weights: Engine _____ Pounds

Generator and Exciter _____ Pounds

Complete Unit, including Common Base ___ Pounds

2. Electric Generator (Manufacturer): _____

Rating _____

Efficiency, at 80% lagging power factor, as determined in accordance with American Institute of Electrical Engineers standardization rules, will not be less than the following:

Full load _____%; 3/4 load _____%; 1/2 load _____%.

DATA SHEET

SUMP PUMP

1. Pump:

   a. Manufacturer's name _____

   b. Model or type _____

   c. Capacity at 40 ft. head at rated speed _____

   d. Shut-off head _____

   e. Pipe size of discharge connection _____

2. Electric motor:

   a. Manufacturer's name _____

   b. Type and rating _____

DATA SHEET

TRAVELING CRANE

a. Manufacturer _____

b. Capacity _____ tons

c. Type _____